JP2002094393

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-094393
(43)Date of publication of application : 29.03.2002

(51)Int.Cl. H04B 1/04
H04H 1/00
H04J 13/04
H04L 7/00

(21)Application number : 2000-283911
(22)Date of filing : 19.09.2000

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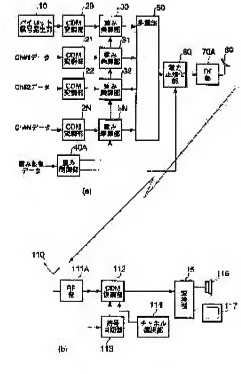
(54) DIGITAL BROADCAST SYSTEM AND ITS TRANSMISSION STATION AND RELAY STATION



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a digital broadcast system that enhances the reception quality for a specific application channel, without decreasing channel multiplex number.
SOLUTION: When there is a specific channel, such as a pilot channel, a pay broadcast channel and a channel for broadcast emergency information through which reception stations MS1-MSm have to receive information with high quality, a weight control section 40A gives a weight coefficient which is larger than others to a weight multiplier section, corresponding to the specific channel to enable the weight multiplier section to multiply the coefficient by transmission data, so as to set the transmission power of the specific channel to a value higher than the transmission power of other channels only for a required period.

CLAIMS

[Claim(s)]

[Claim 1]In a transmitting station for digital broadcasting which multiplexes by carrying out diffusion treatment of the information on two or more channels with a spread code different, respectively, turns a signal after this multiplexing to two or more receiving stations, and carries out wireless transmission, A transmitting station for digital broadcasting possessing a transmission-power-control means which carries out variable setting out of the transmission power for every channel individually according to a use of each of said channel.

[Claim 2]When a pilot channel used in order that said each receiving station may establish a spread code synchronization in said two or more channels is contained, said transmission-power-control means, The transmitting station for digital broadcasting according to claim 1 making transmission power of this pilot channel larger than transmission power of other channels.

[Claim 3]The transmitting station for digital broadcasting according to claim 1 when a free broadcast channel and a paid broadcasting channel are included in said two or more channels, wherein said transmission-power-control means makes transmission power of said paid broadcasting channel larger than transmission power of a free broadcast channel.

[Claim 4]The transmitting station for digital broadcasting according to claim 1 when characterized by comprising the following, wherein said transmission-power-control means makes transmission power of said 2nd channel larger than transmission power of the 1st channel.

The 1st channel that transmits information which has predetermined importance into said two or more channels.

The 2nd channel that transmits information that importance is higher than information transmitted by this 1st channel.

[Claim 5]The transmitting station for digital broadcasting according to claim 1, wherein, as for said transmission-power-control means, only a period which has transmitted information that said importance is high makes transmission power of said 2nd channel larger than transmission power of the 1st channel.

[Claim 6]The transmitting station for digital broadcasting according to claim 1 setting transmission power of the channel concerned as the minimum power value in a period in which said transmission-power-control means supervises existence of information which should be transmitted for every channel, and which does not have information which should be transmitted.

[Claim 7]The transmitting station for digital broadcasting according to any one of claims 1 to 6 providing further an electric power normalization means which holds transmission power of a signal after multiplexing uniformly based on a control result of transmission power to each channel by said transmission-power-control means.

[Claim 8]A digital broadcast system which multiplexes information on two or more channels by carrying out diffusion treatment with a spread code different, respectively in a transmitting station characterized by comprising the following, turns a signal after this

multiplexing to two or more receiving stations, and carries out wireless transmission.
A reception rate calculating means which searches for a reception rate for every channel based on information with which each of two or more of said receiving stations was provided with a reception channel reporting means which notifies information which shows a channel which is a reception schedule during reception to a transmitting station, and it was notified from said each receiving station that said transmitting station was.
A transmission-power-control means to perform control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it based on a reception rate of each channel computed by this reception rate calculating means.

[Claim 9]A transmitting station for digital broadcasting which multiplexes by carrying out diffusion treatment of the information characterized by comprising the following on two or more channels with a spread code different, respectively, turns this multiplexed signal to two or more receiving stations, and carries out wireless transmission.
A reception rate calculating means which searches for a reception rate for every channel based on information which shows a channel which is a reception schedule during reception notified from said each receiving station.
A transmission-power-control means to perform control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it based on a reception rate of each channel computed by this reception rate calculating means.

[Claim 10]A digital broadcast system which multiplexes information on two or more channels by carrying out diffusion treatment with a spread code different, respectively in a transmitting station characterized by comprising the following, turns a signal after this multiplexing to two or more receiving stations, and carries out wireless transmission.
Each of two or more of said receiving stations is provided with a receiving quality reporting means which detects receiving quality of a received channel and notifies the detection result to a transmitting station, and said transmitting station, A receiving quality satisfaction rate calculating means which searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel, based on a detection result of receiving quality notified from said each receiving station.
A transmission-power-control means to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on a receiving quality satisfaction rate of each channel computed by this receiving quality satisfaction rate calculating means.

[Claim 11]A transmitting station for digital broadcasting which multiplexes by carrying out diffusion treatment of the information characterized by comprising the following on two or more channels with a spread code different, respectively, turns this multiplexed signal to two or more receiving stations, and carries out wireless transmission.
A receiving quality satisfaction rate calculating means which searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel, based on a receiving quality detection result of a reception channel notified from said

each receiving station.
A transmission-power-control means to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on a receiving quality satisfaction rate of each channel computed by this receiving quality satisfaction rate calculating means.

[Claim 12]A broadcasting station which distributes information characterized by comprising the following on two or more channels, Two or more relay stations which carry out wireless transmission towards a service area where it multiplexes by carrying out diffusion treatment of the information on two or more channels distributed from this broadcasting station with a spread code different, respectively, and a local station covers this multiplexed signal, A digital broadcast system provided with two or more receiving stations which receive a multiplexed signal in which these relay stations carried out wireless transmission, and reproduce information on a desired channel.
A reception rate calculating means which searches for a reception rate for every channel based on information with which each of two or more of said receiving stations was provided with a reception channel reporting means which notifies information which shows a channel which is a reception schedule during reception to a relay station which becomes transmitting origin of the reception channel concerned, and it was notified from said each receiving station that each of two or more of said relay stations was.
A transmission-power-control means to perform control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it based on a reception rate of each channel computed by this reception rate calculating means.

[Claim 13]A relay station for digital broadcasting which carries out wireless transmission towards two or more receiving stations which exist in a service area where it multiplexes by carrying out diffusion treatment of the information characterized by comprising the following on two or more channels distributed from a broadcasting station with a spread code different, respectively, and a local station covers this multiplexed signal.
A reception rate calculating means which searches for a reception rate for every channel based on information which shows a channel which is a reception schedule during reception notified from said each receiving station.
A transmission-power-control means to perform control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it based on a reception rate of each channel computed by this reception rate calculating means.

[Claim 14]A broadcasting station which distributes information characterized by comprising the following on two or more channels, Two or more relay stations which carry out wireless transmission towards a service area where it multiplexes by carrying out diffusion treatment of the information on two or more channels distributed from this broadcasting station with a spread code different, respectively, and a local station covers this multiplexed signal, A digital broadcast system provided with two or more receiving stations which receive a multiplexed signal in which these relay stations carried out

wireless transmission, and reproduce information on a desired channel.
Each of two or more of said receiving stations detects receiving quality of a received channel, and is provided with a receiving quality reporting means which notifies the detection result to a relay station which becomes transmitting origin of the reception channel concerned, A receiving quality satisfaction rate calculating means which searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel, based on a detection result of receiving quality it was notified from said each receiving station that each of two or more of said relay stations was.
A transmission-power-control means to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on a receiving quality satisfaction rate of each channel computed by this receiving quality satisfaction rate calculating means.

[Claim 15]A relay station for digital broadcasting which carries out wireless transmission towards two or more receiving stations which exist in a service area where it multiplexes by carrying out diffusion treatment of the information characterized by comprising the following on two or more channels distributed from a broadcasting station with a spread code different, respectively, and a local station covers this multiplexed signal.
A receiving quality satisfaction rate calculating means which searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel, based on a detection result of channel receiving quality notified from said each receiving station.
A transmission-power-control means to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on a receiving quality satisfaction rate of each channel computed by this receiving quality satisfaction rate calculating means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the digital broadcast system which adopted the code-division-multiplexing (CDM:Code Division Multiplex) method, and its transmitter station device.
[0002]
[Description of the Prior Art]In recent years, the digital broadcast system which adopted the CDM method attracts attention. Spread spectrum technology is used for the system which adopted the CDM method, and it is constituted as follows, for example.
[0003]That is, a transmitting station modulates first primarily the voice data and the image data which were digitized for every channel with digital modulation methods, such as phase encoding. Next, it transmits, after changing into the sending signal of a broadband, compounding this broadband sending signal and changing into the signal of a radio frequency by carrying out spectrum spread of this modulated send data using a

different spread code for every channel, respectively. On the other hand, a receiver performs spectrum back-diffusion of gas using the spread code corresponding to the channel for which it wishes to the received radio frequency signal. And to the input signal separated by this back-diffusion of gas, digital demodulation methods, such as a phase demodulation method, perform a primary recovery, and received data are reproduced.
[0004]A CDM method is using spread spectrum technology, and has the advantage of being easy to maintain receiving quality highly to change of radio environment, such as phasing.
[0005]By the way, in this kind of system, in order to transmit more information, namely, to raise frequency utilization efficiency in the decided transmission band, it is necessary to increase a channel multiplexed number. However, if the multiplexed number of a channel is increased, interference will occur between channels and it will become easy to produce degradation of receiving quality by the cross correlation of a spread code. If this problem is in the channel which broadcasts important information, including emergency intelligence etc., it is especially anxious for the measure undesirably.
[0006]
[Problem(s) to be Solved by the Invention]Thus, while it has an advantage which says that the digital broadcast system which adopted the CDM method is strong to change of radio environment, when a channel multiplexed number is increased, it has the problem of becoming easy to cause interchannel interference and causing degradation of receiving quality.
[0007]This invention was made paying attention to the above-mentioned situation, and there is a place made into that purpose in providing the digital broadcast system which improved that receiving quality about the channel of the specific use, its transmitting station, and a relay station, without reducing a channel multiplexed number.
[0008]
[Means for Solving the Problem]To achieve the above objects, in a transmitting station for digital broadcasting which multiplexes the 1st invention by carrying out diffusion treatment of the information on two or more channels with a spread code different, respectively, turns a signal after this multiplexing to two or more receiving stations, and carries out wireless transmission, A transmission-power-control means which carries out variable setting out of the transmission power for every channel individually according to a use of each above-mentioned channel is formed.
[0009]As a control content of the above-mentioned transmission-power-control means, the following can be considered, for example.
(1) When a pilot channel used in order that each receiving station may establish a spread code synchronization in two or more channels is contained, make transmission power of this pilot channel larger than transmission power of other channels by a transmission-power-control means.
[0010](2) When a free broadcast channel and a paid broadcasting channel are included in two or more channels, make transmission power of the above-mentioned paid broadcasting channel larger than transmission power of a free broadcast channel by a transmission-power-control means.
[0011](3) The 1st channel that transmits information which has predetermined importance into two or more channels, When the 2nd channel that transmits information that importance is higher than information transmitted by this 1st channel is included,

transmission power of the 2nd channel of the above is made larger than transmission power of the 1st channel by a transmission-power-control means. In that case, as for a transmission-power-control means, only a period which has transmitted information that importance is high makes transmission power of the 2nd channel larger than transmission power of the 1st channel.

[0012](4) Set transmission power of the channel concerned as the minimum power value in a period which supervises existence of information which should be transmitted for every channel by a transmission-power-control means, and does not have information which should be transmitted.

[0013]Therefore, according to this invention, according to a use of a channel, it is transmitted by larger transmission power than other channels about a channel which needs to make a receiving station receive information in high quality. For this reason, even if it is in a state where a channel multiplexed number increases and interchannel interference happens easily, the receiving station can improve receiving quality of a channel which broadcasts important information, including a channel of a specific use, for example, a pilot channel required for an establishes synchronization, a paid broadcasting channel, emergency intelligence, etc.

[0014]Furthermore an electric power normalization means is established and it is characterized also by holding transmission power of a signal after multiplexing uniformly based on a control result of transmission power to each channel by the above-mentioned transmission-power-control means. By doing in this way, transmission power of a transmitting station is always stopped in tolerance level.

[0015]A relay station which carries out CDM multiplex [of the information distributed from a broadcasting station], and transmits is also included not to mention a broadcasting station in the above-mentioned transmitting station.

[0016]In [on the other hand, the 2nd invention notifies information which shows a channel which is a reception schedule during reception from each receiving station to a transmitting station, and] a transmitting station, It asks for a reception rate, i.e., viewership, or an audience rating for every channel based on the above-mentioned information notified from each receiving station, and it controls so that a reception rate makes transmission power of a high channel of a reception rate a bigger value than transmission power of a channel lower than it based on this reception rate.

[0017]Therefore, according to this invention, transmission power of a channel with a high reception rate is set as a value higher than other channels. For this reason, it enables more receiving station users to perform quality reception among front receiving station users.

[0018]In [the 3rd invention detects receiving quality of a reception channel in each receiving station, notifies the detection result to a transmitting station, respectively, and] a transmitting station, A receiving station with which it is satisfied of predetermined receiving quality for every channel based on a detection result of receiving quality notified from each above-mentioned receiving station asks comparatively (it is also called a rate of a place), It controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.

[0019]Therefore, according to this invention, about a channel with which a rate of a receiving station of having satisfied receiving quality is less than a reference value,

transmission power is set as a high value, and transmission power is lowered about a channel with which a rate of a receiving station of having satisfied receiving quality instead has exceeded a reference value. That is, transmission power of each channel will be optimized according to a rate of a receiving station of having satisfied receiving quality. For this reason, extreme receiving quality degradation in a specific channel can be prevented, and dispersion in receiving quality between channels can be reduced.
[0020]Furthermore, the 4th invention is provided with a relay station and multiplexes it by carrying out diffusion treatment of the information on two or more channels distributed from a broadcasting station with a spread code different, respectively, Towards two or more receiving stations which exist in a service area which a local station covers, are this multiplexed signal in a digital broadcast system which carries out wireless transmission, and each of two or more above-mentioned receiving stations, Information which shows a channel which is a reception schedule during reception, or information showing received receiving quality of a channel is notified to a relay station which becomes transmitting origin of the reception channel concerned. On the other hand, each of two or more above-mentioned relay stations searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel based on information showing receiving quality notified in quest of a reception rate for every channel based on information notified from each above-mentioned receiving station. And. [whether based on a reception rate of each of this computed channel, control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it is performed, and] Or based on a receiving quality satisfaction rate of each computed channel, it is made to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it.
[0021]Therefore, in a system which is provided with a relay station for gap fillers, for example according to this invention, According to a rate of a receiving station of having satisfied predetermined receiving quality for every channel corresponding to a reception rate, i.e., viewership, and an audience rating for every channel, variable control of the transmission power for every channel is individually carried out in a relay station. For this reason, also in a system which uses a relay station, optimal transmission power can be performed according to a receiving quality satisfaction rate, corresponding to viewership and an audience rating for every channel.
[0022]
[Embodiment of the Invention](A 1st embodiment) A 1st embodiment of this invention, At a broadcasting station, it is made to carry out variable setting out of the transmission power of each channel individually according to whether it is the use of a channel, for example, the channel which transmits a pilot signal, it is a paid broadcasting channel, or it is a channel which transmits critical information.
[0023]Drawing 1 is an outline lineblock diagram showing a 1st embodiment of the digital broadcast system concerning this invention. Broadcasting station BS carries out CDM multiplex [of the information on two or more channels], and carries out wireless transmission of this digital multiplexed signal towards the service area BE which self covers. Two or more receiving stations MS1-MSm receive the digital multiplexed signal which above-mentioned broadcasting station BS transmitted into the above-mentioned

service area SE. And after separating this received digital multiplexed signal for every channel, a user chooses and does the reproducing output of the channel which wishes viewing and listening or listening.
[0024]The above-mentioned digital multiplexed signal can also be broadcast [also broadcasting by a terrestrial wave from broadcasting station BS, and] via a broadcasting satellite or a communications satellite from broadcasting station BS. There are a thing of the type installed fixed outside indoor, a thing of the type carried in vehicles, and a thing of the type which a user carries in each receiving stations MS1-MSm.
[0025]By the way, above-mentioned broadcasting station BS and each receiving stations MS1-MSm are constituted as follows. Drawing 2 (a) and (b) is a circuit block figure showing the important section composition, respectively.
[0026]The pilot signal which broadcasting station BS has two or more CDM modulation parts 20-2N, and was first generated from the pilot signal generating part 10 at these CDM modulation parts 20-2N, Two or more broadcasting channel Ch#1 generated from the program generation part which is not illustrated - the broadcast data of Ch#N are inputted, respectively. A pilot signal is a known signal used in order to establish the synchronization of a spread code in the receiving stations MS1-MSm, for example, consists of a signal pattern of an oar "1." moreover -- there are what consists of a picture and a sound, a thing which consists only of sounds, and a thing which consists of alphabetic data in each channel Ch#1 - the broadcast data of Ch#N -- the type of these data -- a channel -- or it is chosen by the time zone.
[0027]As opposed to the pilot signal and the broadcast data of each channel into which each CDM modulation parts 20-2N were inputted, respectively, After digital modulation methods, such as a QPSK (Quadrature Phase Shift Keying) method, perform primary abnormal conditions, the multiplication of the PN (Pseudo random Noise) numerals changed for every channel is carried out, and a zone is diffused. The numerals which carried out the multiplication of the orthogonal codes, such as Walsh numerals for securing the orthogonality between channels to long codes which are easy to establish the synchronization of a spread code, such as an M sequence with a long cycle, as a PN code, are used. The Walsh numerals of an oar "0" are used as an object for pilot signals.
[0028]The data modulated by the above-mentioned CDM modulation parts 20-2N is inputted into the dignity multiplication sections 30-3N, respectively. The dignity multiplication sections 30-3N carry out the multiplication of the weighting factor given to the modulation data outputted from the above-mentioned CDM modulation parts 20-2N from the weight control section 40A. The weight control section 40A sets up the weighting factor for every channel according to the dignity control data given from the main control part which is not illustrated, and gives this weighting factor to each above-mentioned dignity multiplication sections 30-3N. Normalized information is given to the electric power normalizing part 60 in order to keep constant the total electric power after channel multiplex [which is fluctuated with the dignity set as each above-mentioned channel with it / all the].
[0029]The multiplex section 50 consists of adding machines, adds the modulation data after weighting outputted from the above-mentioned dignity multiplication sections 30-3N, and outputs the CDM modulation data after this addition to the electric power normalizing part 60. The electric power normalizing part 60 is normalized so that the electric power (amplitude) of the CDM modulation data outputted from the above-

mentioned multiplex section 50 may be set to a constant level according to the normalized information given from the above-mentioned weight control section 40A.
[0030]The wireless section (RF section) 70 changes into radio transmission wave frequency the CDM modulation data outputted from the above-mentioned electric power normalizing part 60, and after it band-limits, it transmits towards a service area from the antenna 80.
[0031]On the other hand, the receiving stations MS1-MSm are constituted as follows. That is, the radio transmission wave signal which came from above-mentioned broadcasting station BS is inputted into the wireless section (RF section) 111A after being received by the antenna 110. After RF section 111A band-limits to the received radio frequency signal, frequency conversion of it is carried out to a baseband signal, and it inputs this receiving baseband signal into the CDM demodulation section 112 and the code synchronization part 113, respectively.
[0032]The code synchronization part 113 extracts the pilot signal sent by the pilot channel from the above-mentioned receiving baseband signal using a matched filter, establishes the synchronous timing of a PN code based on that extraction result, and directs this synchronous timing to the CDM demodulation section 112.
[0033]The CDM demodulation section 112 has a PN code generator, and generates the PN code corresponding to 1 to 1 from the above-mentioned PN code generator to the receiving desired channel in which selected designation was carried out by the channel selection part 114. And back-diffusion of gas is carried out by carrying out the multiplication of this PN code to the above-mentioned receiving baseband signal by the synchronous timing to which it was directed from the above-mentioned code synchronization part 113, Then, for example, it corresponded to the primary modulation method of the transmitting station to the received data after this back-diffusion of gas, QPSK demodulation is performed and this obtains the demodulated data of the above-mentioned receiving desired channel.
[0034]By whether this demodulated data is that data type, i.e., a picture, it is a sound, or it is alphabetic data further. After being changed into a predetermined display format or an audio format by the converter 115, the display for indication 117 and the loudspeaker 116 are supplied, respectively, and it displays and outputs [sound-reinforcement].
[0035]Next, operation of broadcasting station BS of the system constituted as mentioned above is explained. First, for example like pastoral land in service area SE, when there are many places with comparatively little generating of a multipass, the main control part (not shown) of broadcasting station BS gives the dignity control information for setting the transmission power of each channel as the same value to the weight control section 40A. Therefore, the weight control section 40A gives the weighting factor of the same value to all the dignity multiplication sections 30-3N containing the object for pilot channels in this case. For this reason, the multiplication of the weighting factor of the same value is carried out to a pilot signal and the broadcast data of each channel, as a result, with the same transmission power, CDM multiplexing is carried out and a pilot signal and each broadcast data are transmitted.
[0036]On the other hand, when there is much generating of a multipass like a city part and there is much area from which it is easy to start the step-out of a PN code in a receiving station, service area SE, A main control part (not shown) gives the dignity control information for making transmission power of a pilot channel larger than the

transmission power of other broadcasting channels to the weight control section 40A. Therefore, the weight control section 40A makes the weighting factor given to the dignity multiplication section 30 for pilot channels a bigger value than the weighting factor given to the dignity multiplication sections 31-3N of other channels in this case. For this reason, CDM multiplexing is set up and carried out and the power value (amplitude) of a pilot signal is transmitted to a bigger value than the broadcast data of other channels.

[0037]Therefore, even when a multipass exists in the place generated mostly, the receiving stations MS1-MSm in service area SE hold the resolution of a multipass highly, and it becomes possible to be established certainly and to maintain the synchronization to a PN code.

[0038]When a paid broadcasting channel is in two or more above-mentioned broadcasting channels, a main control part gives the dignity control information for making transmission power of this paid broadcasting channel larger than other free broadcast channels to the weight control section 40A. Therefore, a bigger weighting factor than others is given only to the dignity multiplication section 3i for paid broadcasting channels from the weight control section 40A to each dignity multiplication sections 31-3N for broadcasting channels, and, as a result, a paid broadcasting channel is transmitted with bigger transmission power than other free broadcast channels.

[0039]Therefore, when separated comparatively distantly [BS / broadcasting station], or even when the receiving stations MS1-MSm are in the place where receiving quality deteriorates easily like the inside of a building, at least about a paid broadcasting channel, it becomes possible to receive in good quality.

[0040]When the emergency intelligence about a disaster etc. needs to be broadcast, a main control part gives dignity control information only for the period which transmits this emergency intelligence to make transmission power of that broadcasting channel larger than other channels to the weight control section 40A. Therefore, to each dignity multiplication sections 31-3N for broadcasting channels, it restricts to the transmission period of the above-mentioned emergency intelligence from the weight control section 40A, and a bigger weighting factor than others is given only to the dignity multiplication section 3j of the broadcasting channel. For this reason, it restricts to the transmission period of the above-mentioned emergency intelligence, and that broadcasting channel is transmitted with bigger transmission power than other broadcasting channels.

[0041]Therefore, when separated comparatively distantly [BS / broadcasting station], or even when the receiving stations MS1-MSm are in the place where receiving quality deteriorates easily like the inside of a building, it becomes possible to receive the above-mentioned emergency intelligence certainly in good quality at least.

[0042]When there is a broadcasting channel which has non-broadcasting-hours belts, such as night, for example, the dignity control information for setting the transmission power in the non-broadcasting-hours belt of this broadcasting channel as the minimum power value (for example, zero) is given to the weight control section 40A from a main control part. For this reason, if it becomes the above-mentioned non-broadcasting-hours belt, the transmission power of the broadcasting channel concerned will be set as zero. Therefore, on the above-mentioned non-broadcasting-hours belt, the substantial broadcasting channel multiplexed number of a system can be reduced, and the receiving quality of each channel which is broadcasting by this can be improved on it.

[0043]Like the channel which broadcasts a pilot channel, a paid broadcasting channel,

and emergency intelligence as having stated above by a 1st embodiment, When the specific channel which needs to make information receive for high quality is in the receiving stations MS1-MSm, A bigger weighting factor than others is given from the weight control section 40A to the dignity multiplication section corresponding to the specific channel concerned, and he carries out multiplication to send data, and is trying only for a required period to set the transmission power of a specific channel as a bigger value than the transmission power of other channels by this. Therefore, the receiving quality can be improved about the channel of a specific use, without reducing a channel multiplexed number.

[0044](A 2nd embodiment) A 2nd embodiment of this invention, In [notify the number of the channel which is a reception schedule during reception from each receiving station to a broadcasting station, and] a broadcasting station, On a basis the channel designator under receiving selection notified from each receiving station The reception rate for every channel, That is, it asks for viewership or an audience rating, and it is made to carry out dignity control so that a reception rate may make transmission power of the high channel of a reception rate a bigger value than the transmission power of a channel lower than it based on this reception rate.

[0045]Drawing 3 (a) and (b) is a circuit block figure showing the composition of the broadcasting station of a digital broadcast system, and a receiving station concerning a 2nd embodiment of this invention. In the figure, identical codes are given to said drawing 2 (a), (b), and identical parts, and detailed explanation is omitted.

[0046]The receiving stations MS1-MSm are first provided with the following.

About the number of the channel under receiving selection, the time of a channel selection, or in order to notify to broadcasting station BS periodically, it is the modulation part 118B.

RF section 111B provided with the transmission system.

The modulation part 118B modulates the notice data containing the channel designator under selection outputted from the channel selection part 114 with digital modulation methods, such as a QPSK method, and supplies the signal after these abnormal conditions to RF section 111B. After RF section 111B carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards broadcasting station BS from the antenna 110. As the above-mentioned going-up channel, the communications channel of a portable telephone system or PHS (Personal Handyphone System) may be used, for example.

[0047]On the other hand, broadcasting station BS is provided with RF section 70B and the demodulation section 90 provided with the receiving system, in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 70B receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 90. The demodulation section 90 reproduces notice data by carrying out QPSK demodulation of the above-mentioned input signal.

[0048]Broadcasting station BS is provided with the weight control section 40B which operates according to the channel reception rate calculation part 100 and its computed

result. The channel reception rate calculation part 100 based on the channel designator under receiving selection notified with notice data from each receiving stations MS1-MSm, This broadcasting channel is asked for the number of the receiving stations under receiving selection for every broadcasting channel, and it computes from that value, the viewership or the audience rating, i.e., the reception rate, for every broadcasting channel.
[0049]The weight control section 40B enlarges transmission power of a broadcasting channel with many receiving stations under present receiving selection according to the computed result of the above-mentioned reception rate, The weighting factor for every broadcasting channel is set up so that the receiving station under present receiving selection may make transmission power of few broadcasting channels small instead, and this weighting factor is given to the dignity multiplication sections 31-3N. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 60.
[0050]Since it is such composition, if a user performs selection operation of a channel in each receiving stations MS1-MSm, After the notice data containing this selected channel designator is inputted into the modulation part 118B from the channel selection part 114 and QPSK modulation is carried out by this modulation part 118B, it goes up from RF section 111B, and is transmitted towards broadcasting station BS via a channel.
[0051]On the other hand, by broadcasting station BS, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 70B, it will get over by the demodulation section 90, notice data will be reproduced, and it will be inputted into the channel reception rate calculation part 100. In the channel reception rate calculation part 100, whenever notice data comes from the receiving stations MS1-MSm, the reception rate for every channel is recalculated based on the channel designator inserted in this notice data, and the calculation result of this reception rate is notified to the weight control section 40B.
[0052]The weight control section 40B computes the new weighting factor for every channel based on the calculation result of the above-mentioned reception rate. For example, now, the reception rate of broadcasting channel Ch#i increases remarkably, and presupposes that the reception rate of broadcasting channel Ch#j fell. If it does so, the weight control section 40B changes a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase, and it will change a weighting factor into a small value in order to reduce the transmission power of broadcasting channel Ch#j on the contrary.
[0053]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 31-3N according to this weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards service area SE from RF section 70B, after being normalized so that it may multiplex by the multiplex section 50 and the total electric power may become fixed by the electric power normalizing part 60.
[0054]If it is a 2nd embodiment, corresponding [therefore,] to the reception rate, i.e., the viewership, or audience rating of each broadcasting channel, Since transmission power is enlarged as a high channel and it was made for a reception rate to reduce transmission power relatively about a channel with a reception rate low on the contrary, Even when

there are many channel multiplexed numbers and generating of interchannel interference is not avoided, many receiving station users become possible [receiving broadcast data with high quality].
[0055]When there is a broadcasting channel without the receiving station under reception, i.e., the broadcasting channel of a reception rate "0", in the weight control section 40B, the weighting factor to the broadcasting channel concerned is set as "0", and, as a result, the transmission power of the above-mentioned broadcasting channel is set to "0." Therefore, it becomes possible to heighten the transmission power of a broadcasting channel besides the part, and the receiving quality of the receiving station which has received these broadcasting channels can be improved.
[0056](A 3rd embodiment) A 3rd embodiment of this invention, In [in each receiving station, detect the receiving quality of the channel under receiving selection, notify the detection result to a broadcasting station, and] a broadcasting station, The receiving station with which it is satisfied of predetermined receiving quality for every channel based on the detection result of the receiving quality notified from each above-mentioned receiving station comparatively, That is, it asks for a receiving quality satisfaction rate, and controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than the transmission power of the channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.
[0057]Drawing 4 (a) and (b) is a circuit block figure showing the composition of the broadcasting station of a digital broadcast system, and a receiving station concerning a 3rd embodiment of this invention. In the figure, identical codes are given to said drawing 3 (a), (b), and identical parts, and detailed explanation is omitted.
[0058]The receiving stations MS1-MSm are first provided with the following.
In order to notify BER which was provided with the BER test section 119 which carries out digital error rate (BER:Bit Error Rate) measurement, and was measured further to broadcasting station BS with the channel designator under receiving selection, it is the modulation part 118C.
RF section 111C provided with the transmission system.

[0059]The modulation part 118C modulates the notice data containing BER measured by the above-mentioned BER test section 119 and the channel designator under receiving selection outputted from the channel selection part 114 with digital modulation methods, such as a QPSK method, and supplies the signal after these abnormal conditions to RF section 111C. After RF section 111C carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards broadcasting station BS from the antenna 110. As the above-mentioned going-up channel, the communications channel of a portable telephone system or PHS (Personal Handyphone System) may be used like said 3rd embodiment, for example.
[0060]On the other hand, broadcasting station BS is provided with RF section 70C and the demodulation section 90 provided with the receiving system, in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 70C receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out

to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 90. The demodulation section 90 reproduces notice data by carrying out QPSK demodulation of the above-mentioned input signal.

[0061]Broadcasting station BS is provided with the weight control section 40C which operates according to the receiving quality satisfaction rate calculation part 101 and its computed result. Based on the channel designator and BER under receiving selection notified with notice data from each receiving stations MS1-MSm, the receiving station with which it is satisfied of predetermined receiving quality for every broadcasting channel is comparatively got blocked, and the receiving quality satisfaction rate calculation part 101 asks for a receiving quality satisfaction rate.

[0062]According to the computed result of the above-mentioned reception rate, a receiving quality satisfaction rate enlarges transmission power of a broadcasting channel lower than a reference value, and the weight control section 40C controls it for more than the margin whose receiving quality satisfaction rate is more nearly constant than a reference value to make transmission power of a high broadcasting channel into a small value on the contrary. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 60.

[0063]Since it is such composition, in each receiving stations MS1-MSm. After being inserted in notice data with the channel designator which BER measured by the BER test section 119 is receiving, being inputted into the modulation part 118C and carrying out QPSK modulation by this modulation part 118C during reception, it goes up from RF section 111C, and is transmitted towards broadcasting station BS via a channel.

[0064]On the other hand, by broadcasting station BS, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 70C, it will get over by the demodulation section 90, notice data will be reproduced, and it will be inputted into the receiving quality satisfaction rate calculation part 101. In the receiving **** satisfaction rate calculation part 101, whenever notice data comes from the receiving stations MS1-MSm, The receiving quality satisfaction rate for every channel is calculated based on the number of BER inserted in this notice data, and its channel, and the calculation result of this receiving quality satisfaction rate is notified to the weight control section 40C.

[0065]The weight control section 40C computes the new weighting factor for every broadcasting channel based on the calculation result of the above-mentioned receiving quality satisfaction rate. For example, the receiving quality satisfaction rate of broadcasting channel Ch#i presupposes that it fell from the reference value now. If it does so, the weight control section 40C will change a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase. On the other hand, suppose that more than the margin with a constant receiving quality satisfaction rate of broadcasting channel Ch#j became high. In this case, a weighting factor is changed into a small value in order to reduce the transmission power of broadcasting channel Ch#j.

[0066]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 31-3N according to this

weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards service area SE from RF section 70C, after being normalized so that it may multiplex by the multiplex section 50 and the total electric power may become fixed by the electric power normalizing part 60.
[0067]Therefore, it is increased by the transmission power of a broadcasting channel with many receiving stations in service area SE are not satisfied with receiving quality of receiving stations, and, as a result, the receiving quality of the broadcasting channel concerned improves.
[0068]Also in this embodiment, about a broadcasting channel without the receiving station under reception, in the weight control section 40C, the weighting factor to the broadcasting channel concerned is set as "0", and, as a result, the transmission power of the above-mentioned broadcasting channel is set to "0." Therefore, it becomes possible to heighten the transmission power of a broadcasting channel besides the part, and the receiving quality of the receiving station which has received these broadcasting channels can be improved.
[0069](A 4th embodiment) A 4th embodiment of this invention, Have two or more relay stations which constitute a cell, and it multiplexes by carrying out diffusion treatment of the information on two or more channels distributed from the broadcasting station with a spread code different, respectively, Towards two or more receiving stations which exist in the cell which a local station covers, are this CDM multiplexed signal in the digital broadcast system which carries out wireless transmission, and each of two or more above-mentioned receiving stations, In [go up a self position register with a relay station via a channel, and detect the receiving quality of the channel under receiving selection, notify the detection result to a relay station, and] a relay station, The receiving station with which it is satisfied of predetermined receiving quality for every channel based on the detection result of the receiving quality notified from each above-mentioned receiving station comparatively, That is, it asks for a receiving quality satisfaction rate, and controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than the transmission power of the channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.
[0070]Drawing 5 is an outline lineblock diagram of the digital broadcast system concerning a 4th embodiment of this invention. Two or more relay stations (the case of three games is illustrated in the figure) RS1-RS3 are distributed and allocated in the service area which a system covers. It is connected to broadcast main station BSS via a wire circuit, respectively, and these relay stations RS1-RS3 receive the data of each same broadcasting channel distributed from broadcast main station BSS. And CDM multiplex [of the data of these broadcasting channels] is carried out with a pilot signal, and it transmits to the relay service areas RE1-RE3 which self forms, respectively. Each receiving stations MS1-MSm receive a broadcasting signal with the most sufficient receiving quality selectively among the broadcasting signals which come from each relay stations RS1-RS3.
[0071]It is also possible between broadcast main station BSS and each relay stations RS1-RS3 to connect via a wireless circuit in addition to a wire circuit.
[0072]Drawing 6 (a) and (b) is a circuit block figure showing the important section composition of the above-mentioned relay stations RS1-RS3 and the receiving stations MS1-MSm, respectively. Identical codes are given to said drawing 5 (b) and identical

parts among the composition of the receiving stations MS1-MSm, and detailed explanation is omitted.

[0073]The relay stations RS1-RS3 have two or more CDM modulation parts 220-22N first like broadcasting station BS described by said drawing 2 (a), Two or more broadcasting channel Ch#1 which received from said broadcast main station BSS - the broadcast data of Ch#N are inputted into these CDM modulation parts 220-22N as the pilot signal generated from the pilot signal generating part 210, respectively. A pilot signal is a known signal used in order to establish the synchronization of a spread code in the receiving stations MS1-MSm, for example, consists of a signal pattern of an oar "1." moreover -- there are what consists of a picture and a sound, a thing which consists only of sounds, and a thing which consists of alphabetic data in each channel Ch#1 - the broadcast data of Ch#N -- the type of these data -- a channel -- or it is chosen by the time zone.

[0074]After each CDM modulation parts 220-22N perform primary abnormal conditions with digital modulation methods, such as a QPSK method, to the pilot signal and the broadcast data of each channel which were inputted, respectively, they carry out the multiplication of the PN code changed for every channel, and diffuse a zone. The numerals which carried out the multiplication of the orthogonal codes, such as Walsh numerals for securing the orthogonality between channels to long codes which are easy to establish the synchronization of a spread code, such as an M sequence with a long cycle, as a PN code, are used. The Walsh numerals of an oar "0" are used as an object for pilot signals.

[0075]The data modulated by the above-mentioned CDM modulation parts 220-22N is inputted into the dignity multiplication sections 230-23N, respectively. The dignity multiplication sections 230-23N carry out the multiplication of the weighting factor given to the modulation data outputted from the above-mentioned CDM modulation parts 220-22N from the weight control section 240.

[0076]The multiplex section 250 consists of adding machines, adds the modulation data after weighting outputted from the above-mentioned dignity multiplication sections 230-23N, and outputs the CDM modulation data after this addition to the electric power normalizing part 260. The electric power normalizing part 260 is normalized so that the electric power (amplitude) of the CDM modulation data outputted from the above-mentioned multiplex section 250 may be set to a constant level according to the normalized information given from the above-mentioned weight control section 240.

[0077]The wireless section (RF section) 270 changes into radio transmission wave frequency the CDM modulation data outputted from the above-mentioned electric power normalizing part 260, and after it band-limits, it transmits towards a service area from the antenna 280.

[0078]By the way, the relay stations RS1-RS3 of this embodiment are provided with RF section 270 and the demodulation section 290 provided with the receiving system in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 270 receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 290. The demodulation section 290 reproduces notice data by carrying out QPSK demodulation of

the above-mentioned input signal.
[0079]The relay stations RS1-RS3 are provided with the weight control section 240 which operates according to the receiving quality satisfaction rate calculation part 300 and its computed result. The receiving quality satisfaction rate calculation part 300 based on the channel designator and BER under receiving selection notified with notice data from the receiving station which has received the broadcasting channel of a local station among each receiving stations MS1-MSm, The receiving station with which it is satisfied of predetermined receiving quality for every broadcasting channel is comparatively got blocked, and it asks for a receiving quality satisfaction rate.
[0080]According to the computed result of the above-mentioned receiving quality satisfaction rate, a receiving quality satisfaction rate enlarges transmission power of a broadcasting channel lower than a reference value, and the weight control section 240 controls it for more than the margin whose receiving quality satisfaction rate is more nearly constant than a reference value to make transmission power of a high broadcasting channel into a small value on the contrary. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 260.
[0081]Furthermore, the relay stations RS1-RS3 are provided with the receiving station registration control section 310. The receiving station registration control section 310 creates the list of receiving stations which exist in the relay service areas RE1-RE3 of a local station based on the identification number of the receiving station of the transmitting origin included in the above-mentioned notice data which was gone up from the receiving stations MS1-MSm, and was received via the channel. In the above-mentioned receiving quality satisfaction rate calculation part 300, this list is used in order to compute the receiving quality satisfaction rate by the receiving station which has received the broadcasting channel of a local station.
[0082]The receiving station registration control section 310 also has a function which notifies the identification number of a local station to the receiving stations MS1-MSm. That is, the identification number of a local station is given to the above-mentioned notice data pilot signal generating part 210, and thereby, the identification number of a local station is inserted in a part of pilot signal, and it is made to transmit to it.
[0083]On the other hand, the receiving stations MS1-MSm are provided with the following.
The BER test section 119 which measures BER of the broadcasting channel under reception.
Registration control section 120.
The registration control section 120 extracts and holds the identification number of the relay station RSi of a transmitting agency from the largest pilot signal of the receiving level detected by the code synchronization part 113. And in order to register a local station to the relay station RSi under this reception, the identification number of the relay station which extracted [above-mentioned], and the identification number of a local station are given to the modulation part 118D.
[0084]The modulation part 118D creates the notice data containing BER measured by the above-mentioned BER test section 119, the channel designator under receiving selection outputted from the channel selection part 114, the identification number of the relay station RSi which the local station given from the above-mentioned registration control

section 120 is receiving, and the identification number of a local station. And this notice data is modulated with digital modulation methods, such as a QPSK method, and the signal after these abnormal conditions is supplied to RF section 111D. After RF section 111D carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards the relay station RSi under reception from the antenna 110.
[0085]Since it is such composition, when beginning to receive the broadcasting channel from the arbitrary relay stations RSi, BER of the broadcasting channel under this reception is measured by the BER test section 119 during reception in each receiving stations MS1-MSm. And after the measured value of this BER is inserted in notice data with the number of the broadcasting channel under reception, and is inputted into the modulation part 118D and QPSK modulation is carried out by this modulation part 118D, it goes up from RF section 111D, and is transmitted towards the relay station RSi via a channel. In that case, the identification number of the relay station RSi under above-mentioned reception extracted by the registration control section 120 and the identification number of a local station are inserted and transmitted to the above-mentioned notice data.
[0086]On the other hand, in the relay station RSi, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 270, it will get over by the demodulation section 290, notice data will be reproduced, and it will be inputted into the receiving quality satisfaction rate calculation part 300 and the receiving station registration control section 310, respectively. In the receiving station registration control section 310, ********** extraction of the number of the relay station which serves as a transmission destination, and the identification number of the receiving station of a transmitting agency is carried out from the notice data which came from each receiving station. And the list of receiving stations while receiving the broadcasting channel which the local station has transmitted based on these identification numbers is created.
[0087]Whenever notice data comes, transmitting [the notice data concerned] origin judges the receiving **** satisfaction rate calculation part 300 based on the list created [whether it is a receiving station while receiving the broadcasting channel which the local station has transmitted, and] by the above-mentioned receiving registration control section 310. And if transmitting [notice data] origin is a receiving station while receiving the broadcasting channel which the local station has transmitted, it will compute the receiving quality satisfaction rate for every channel based on the number of BER inserted in the notice data concerned, and its channel, and will notify the calculation result of this receiving quality satisfaction rate to the weight control section 240.
[0088]The weight control section 240 computes the new weighting factor for every broadcasting channel based on the calculation result of the above-mentioned receiving quality satisfaction rate. For example, the receiving quality satisfaction rate of broadcasting channel Ch#i presupposes that it fell from the reference value now. If it does so, the weight control section 240 will change a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase. On the other hand, suppose that more than the margin with a constant receiving quality satisfaction rate of broadcasting channel Ch#j became high. In this case, a weighting factor is changed into a small value in order to reduce the transmission power of

broadcasting channel Ch#j.
[0089]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 231-23N according to this weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards the relay service area REi from RF section 270, after being normalized so that it may multiplex by the multiplex section 250 and the total electric power may become fixed by the electric power normalizing part 260.
[0090]Therefore, it is increased by the transmission power of a broadcasting channel with many receiving stations with which it is not satisfied of receiving quality every relay service areas RE1-RE3, and, as a result, the receiving quality of the broadcasting channel concerned improves.
[0091]This invention is not limited to each above-mentioned embodiment. For example, by said 4th embodiment, in each relay stations RS1-RS3, the receiving quality satisfaction rate for every [by each receiving station which has received the broadcasting channel from a local station] channel was computed, respectively, and the case where variable control of the transmission power of each broadcasting channel was carried out based on this receiving quality satisfaction rate was described. However, not only in this but in each relay stations RS1-RS3, the reception rate for every [by each receiving station which has received the broadcasting channel from a local station] broadcasting channel is computed, respectively, and it may be made to carry out variable control of the transmission power of each broadcasting channel based on this reception rate.
[0092]In each relay stations RS1-RS3 shown in a 4th embodiment, like a pilot channel, a paid broadcasting channel, and the channel that broadcasts emergency intelligence, respectively, When the specific channel which needs to make information receive for high quality is in the receiving stations MS1-MSm, A bigger weighting factor than others is given from the weight control section 240 to the dignity multiplication section corresponding to the specific channel concerned, multiplication is carried out to send data, and it may be made only for a required period to set the transmission power of a specific channel as a bigger value than the transmission power of other channels by this.
[0093]In addition, about the circuitry of a broadcasting station, a relay station, and a receiving station, the transmission-power-control procedure for every channel, its contents, etc., in the range which does not deviate from the gist of this invention, it changes variously and can carry out.
[0094]
[Effect of the Invention]In the transmitting station for digital broadcasting which multiplexes by carrying out diffusion treatment of the information on two or more channels with a spread code different, respectively in this invention as explained in full detail above, turns the signal after this multiplexing to two or more receiving stations, and carries out wireless transmission, According to the use of each above-mentioned channel, it is made to carry out variable setting out of the transmission power for every channel by a transmission-power-control means individually.
[0095]Therefore, according to this invention, the digital broadcast system which can improve that receiving quality about the channel of a specific use, its transmitting station, and a relay station can be provided, without reducing a channel multiplexed number.

TECHNICAL FIELD

[Field of the Invention]This invention relates to the digital broadcast system which adopted the code-division-multiplexing (CDM:Code Division Multiplex) method, and its transmitter station device.

PRIOR ART

[Description of the Prior Art]In recent years, the digital broadcast system which adopted the CDM method attracts attention. Spread spectrum technology is used for the system which adopted the CDM method, and it is constituted as follows, for example.
[0003]That is, a transmitting station modulates first primarily the voice data and the image data which were digitized for every channel with digital modulation methods, such as phase encoding. Next, it transmits, after changing into the sending signal of a broadband, compounding this broadband sending signal and changing into the signal of a radio frequency by carrying out spectrum spread of this modulated send data using a different spread code for every channel, respectively. On the other hand, a receiver performs spectrum back-diffusion of gas using the spread code corresponding to the channel for which it wishes to the received radio frequency signal. And to the input signal separated by this back-diffusion of gas, digital demodulation methods, such as a phase demodulation method, perform a primary recovery, and received data are reproduced.
[0004]A CDM method is using spread spectrum technology, and has the advantage of being easy to maintain receiving quality highly to change of radio environment, such as phasing.
[0005]By the way, in this kind of system, in order to transmit more information, namely, to raise frequency utilization efficiency in the decided transmission band, it is necessary to increase a channel multiplexed number. However, if the multiplexed number of a channel is increased, interference will occur between channels and it will become easy to produce degradation of receiving quality by the cross correlation of a spread code. If this problem is in the channel which broadcasts important information, including emergency intelligence etc., it is especially anxious for the measure undesirably.

EFFECT OF THE INVENTION

[Effect of the Invention]In the transmitting station for digital broadcasting which multiplexes by carrying out diffusion treatment of the information on two or more channels with a spread code different, respectively in this invention as explained in full detail above, turns the signal after this multiplexing to two or more receiving stations, and carries out wireless transmission, According to the use of each above-mentioned channel, it is made to carry out variable setting out of the transmission power for every channel by a transmission-power-control means individually.
[0095]Therefore, according to this invention, the digital broadcast system which can

improve that receiving quality about the channel of a specific use, its transmitting station, and a relay station can be provided, without reducing a channel multiplexed number.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Thus, while it has an advantage which says that the digital broadcast system which adopted the CDM method is strong to change of radio environment, when a channel multiplexed number is increased, it has the problem of becoming easy to cause interchannel interference and causing degradation of receiving quality.

[0007]This invention was made paying attention to the above-mentioned situation, and there is a place made into that purpose in providing the digital broadcast system which improved that receiving quality about the channel of the specific use, its transmitting station, and a relay station, without reducing a channel multiplexed number.

MEANS

[Means for Solving the Problem]To achieve the above objects, in a transmitting station for digital broadcasting which multiplexes the 1st invention by carrying out diffusion treatment of the information on two or more channels with a spread code different, respectively, turns a signal after this multiplexing to two or more receiving stations, and carries out wireless transmission, A transmission-power-control means which carries out variable setting out of the transmission power for every channel individually according to a use of each above-mentioned channel is formed.

[0009]As a control content of the above-mentioned transmission-power-control means, the following can be considered, for example.

(1) When a pilot channel used in order that each receiving station may establish a spread code synchronization in two or more channels is contained, make transmission power of this pilot channel larger than transmission power of other channels by a transmission-power-control means.

[0010](2) When a free broadcast channel and a paid broadcasting channel are included in two or more channels, make transmission power of the above-mentioned paid broadcasting channel larger than transmission power of a free broadcast channel by a transmission-power-control means.

[0011](3) The 1st channel that transmits information which has predetermined importance into two or more channels, When the 2nd channel that transmits information that importance is higher than information transmitted by this 1st channel is included, transmission power of the 2nd channel of the above is made larger than transmission power of the 1st channel by a transmission-power-control means. In that case, as for a transmission-power-control means, only a period which has transmitted information that importance is high makes transmission power of the 2nd channel larger than transmission power of the 1st channel.

[0012](4) Set transmission power of the channel concerned as the minimum power value in a period which supervises existence of information which should be transmitted for

every channel by a transmission-power-control means, and does not have information which should be transmitted.
[0013]Therefore, according to this invention, according to a use of a channel, it is transmitted by larger transmission power than other channels about a channel which needs to make a receiving station receive information in high quality. For this reason, even if it is in a state where a channel multiplexed number increases and interchannel interference happens easily, the receiving station can improve receiving quality of a channel which broadcasts important information, including a channel of a specific use, for example, a pilot channel required for an establishes synchronization, a paid broadcasting channel, emergency intelligence, etc.
[0014]Furthermore an electric power normalization means is established and it is characterized also by holding transmission power of a signal after multiplexing uniformly based on a control result of transmission power to each channel by the above-mentioned transmission-power-control means. By doing in this way, transmission power of a transmitting station is always stopped in tolerance level.
[0015]A relay station which carries out CDM multiplex [of the information distributed from a broadcasting station], and transmits is also included not to mention a broadcasting station in the above-mentioned transmitting station.
[0016]In [on the other hand, the 2nd invention notifies information which shows a channel which is a reception schedule during reception from each receiving station to a transmitting station, and] a transmitting station, It asks for a reception rate, i.e., viewership, or an audience rating for every channel based on the above-mentioned information notified from each receiving station, and it controls so that a reception rate makes transmission power of a high channel of a reception rate a bigger value than transmission power of a channel lower than it based on this reception rate.
[0017]Therefore, according to this invention, transmission power of a channel with a high reception rate is set as a value higher than other channels. For this reason, it enables more receiving station users to perform quality reception among front receiving station users.
[0018]In [the 3rd invention detects receiving quality of a reception channel in each receiving station, notifies the detection result to a transmitting station, respectively, and] a transmitting station, A receiving station with which it is satisfied of predetermined receiving quality for every channel based on a detection result of receiving quality notified from each above-mentioned receiving station asks comparatively (it is also called a rate of a place), It controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.
[0019]Therefore, according to this invention, about a channel with which a rate of a receiving station of having satisfied receiving quality is less than a reference value, transmission power is set as a high value, and transmission power is lowered about a channel with which a rate of a receiving station of having satisfied receiving quality instead has exceeded a reference value. That is, transmission power of each channel will be optimized according to a rate of a receiving station of having satisfied receiving quality. For this reason, extreme receiving quality degradation in a specific channel can be prevented, and dispersion in receiving quality between channels can be reduced.
[0020]Furthermore, the 4th invention is provided with a relay station and multiplexes it

by carrying out diffusion treatment of the information on two or more channels distributed from a broadcasting station with a spread code different, respectively, Towards two or more receiving stations which exist in a service area which a local station covers, are this multiplexed signal in a digital broadcast system which carries out wireless transmission, and each of two or more above-mentioned receiving stations, Information which shows a channel which is a reception schedule during reception, or information showing received receiving quality of a channel is notified to a relay station which becomes transmitting origin of the reception channel concerned. On the other hand, each of two or more above-mentioned relay stations searches for a rate of a receiving station of having satisfied predetermined receiving quality for every channel based on information showing receiving quality notified in quest of a reception rate for every channel based on information notified from each above-mentioned receiving station. And. [whether based on a reception rate of each of this computed channel, control for setting transmission power of a high channel of a reception rate as a bigger value than transmission power of a channel in which a reception rate is lower than it is performed, and] Or based on a receiving quality satisfaction rate of each computed channel, it is made to perform control for setting transmission power of a channel with a low receiving quality satisfaction rate as a bigger value than transmission power of a channel whose receiving quality satisfaction rate is higher than it.

[0021]Therefore, in a system which is provided with a relay station for gap fillers, for example according to this invention, According to a rate of a receiving station of having satisfied predetermined receiving quality for every channel corresponding to a reception rate, i.e., viewership, and an audience rating for every channel, variable control of the transmission power for every channel is individually carried out in a relay station. For this reason, also in a system which uses a relay station, optimal transmission power can be performed according to a receiving quality satisfaction rate, corresponding to viewership and an audience rating for every channel.

[0022]

[Embodiment of the Invention](A 1st embodiment) A 1st embodiment of this invention, At a broadcasting station, it is made to carry out variable setting out of the transmission power of each channel individually according to whether it is the use of a channel, for example, the channel which transmits a pilot signal, it is a paid broadcasting channel, or it is a channel which transmits critical information.

[0023]Drawing 1 is an outline lineblock diagram showing a 1st embodiment of the digital broadcast system concerning this invention. Broadcasting station BS carries out CDM multiplex [of the information on two or more channels], and carries out wireless transmission of this digital multiplexed signal towards the service area BE which self covers. Two or more receiving stations MS1-MSm receive the digital multiplexed signal which above-mentioned broadcasting station BS transmitted into the above-mentioned service area SE. And after separating this received digital multiplexed signal for every channel, a user chooses and does the reproducing output of the channel which wishes viewing and listening or listening.

[0024]The above-mentioned digital multiplexed signal can also be broadcast [also broadcasting by a terrestrial wave from broadcasting station BS, and] via a broadcasting satellite or a communications satellite from broadcasting station BS. There are a thing of the type installed fixed outside indoor, a thing of the type carried in vehicles, and a thing

of the type which a user carries in each receiving stations MS1-MSm.
[0025]By the way, above-mentioned broadcasting station BS and each receiving stations MS1-MSm are constituted as follows. Drawing 2 (a) and (b) is a circuit block figure showing the important section composition, respectively.
[0026]The pilot signal which broadcasting station BS has two or more CDM modulation parts 20-2N, and was first generated from the pilot signal generating part 10 at these CDM modulation parts 20-2N, Two or more broadcasting channel Ch#1 generated from the program generation part which is not illustrated - the broadcast data of Ch#N are inputted, respectively. A pilot signal is a known signal used in order to establish the synchronization of a spread code in the receiving stations MS1-MSm, for example, consists of a signal pattern of an oar "1." moreover -- there are what consists of a picture and a sound, a thing which consists only of sounds, and a thing which consists of alphabetic data in each channel Ch#1 - the broadcast data of Ch#N -- the type of these data -- a channel -- or it is chosen by the time zone.
[0027]As opposed to the pilot signal and the broadcast data of each channel into which each CDM modulation parts 20-2N were inputted, respectively, After digital modulation methods, such as a QPSK (Quadrature Phase Shift Keying) method, perform primary abnormal conditions, the multiplication of the PN (Pseudo random Noise) numerals changed for every channel is carried out, and a zone is diffused. The numerals which carried out the multiplication of the orthogonal codes, such as Walsh numerals for securing the orthogonality between channels to long codes which are easy to establish the synchronization of a spread code, such as an M sequence with a long cycle, as a PN code, are used. The Walsh numerals of an oar "0" are used as an object for pilot signals.
[0028]The data modulated by the above-mentioned CDM modulation parts 20-2N is inputted into the dignity multiplication sections 30-3N, respectively. The dignity multiplication sections 30-3N carry out the multiplication of the weighting factor given to the modulation data outputted from the above-mentioned CDM modulation parts 20-2N from the weight control section 40A. The weight control section 40A sets up the weighting factor for every channel according to the dignity control data given from the main control part which is not illustrated, and gives this weighting factor to each above-mentioned dignity multiplication sections 30-3N. Normalized information is given to the electric power normalizing part 60 in order to keep constant the total electric power after channel multiplex [which is fluctuated with the dignity set as each above-mentioned channel with it / all the].
[0029]The multiplex section 50 consists of adding machines, adds the modulation data after weighting outputted from the above-mentioned dignity multiplication sections 30-3N, and outputs the CDM modulation data after this addition to the electric power normalizing part 60. The electric power normalizing part 60 is normalized so that the electric power (amplitude) of the CDM modulation data outputted from the above-mentioned multiplex section 50 may be set to a constant level according to the normalized information given from the above-mentioned weight control section 40A.
[0030]The wireless section (RF section) 70 changes into radio transmission wave frequency the CDM modulation data outputted from the above-mentioned electric power normalizing part 60, and after it band-limits, it transmits towards a service area from the antenna 80.
[0031]On the other hand, the receiving stations MS1-MSm are constituted as follows.

That is, the radio transmission wave signal which came from above-mentioned broadcasting station BS is inputted into the wireless section (RF section) 111A after being received by the antenna 110. After RF section 111A band-limits to the received radio frequency signal, frequency conversion of it is carried out to a baseband signal, and it inputs this receiving baseband signal into the CDM demodulation section 112 and the code synchronization part 113, respectively.

[0032]The code synchronization part 113 extracts the pilot signal sent by the pilot channel from the above-mentioned receiving baseband signal using a matched filter, establishes the synchronous timing of a PN code based on that extraction result, and directs this synchronous timing to the CDM demodulation section 112.

[0033]The CDM demodulation section 112 has a PN code generator, and generates the PN code corresponding to 1 to 1 from the above-mentioned PN code generator to the receiving desired channel in which selected designation was carried out by the channel selection part 114. And back-diffusion of gas is carried out by carrying out the multiplication of this PN code to the above-mentioned receiving baseband signal by the synchronous timing to which it was directed from the above-mentioned code synchronization part 113, Then, for example, it corresponded to the primary modulation method of the transmitting station to the received data after this back-diffusion of gas, QPSK demodulation is performed and this obtains the demodulated data of the above-mentioned receiving desired channel.

[0034]By whether this demodulated data is that data type, i.e., a picture, it is a sound, or it is alphabetic data further. After being changed into a predetermined display format or an audio format by the converter 115, the display for indication 117 and the loudspeaker 116 are supplied, respectively, and it displays and outputs [sound-reinforcement].

[0035]Next, operation of broadcasting station BS of the system constituted as mentioned above is explained. First, for example like pastoral land in service area SE, when there are many places with comparatively little generating of a multipass, the main control part (not shown) of broadcasting station BS gives the dignity control information for setting the transmission power of each channel as the same value to the weight control section 40A. Therefore, the weight control section 40A gives the weighting factor of the same value to all the dignity multiplication sections 30-3N containing the object for pilot channels in this case. For this reason, the multiplication of the weighting factor of the same value is carried out to a pilot signal and the broadcast data of each channel, as a result, with the same transmission power, CDM multiplexing is carried out and a pilot signal and each broadcast data are transmitted.

[0036]On the other hand, when there is much generating of a multipass like a city part and there is much area from which it is easy to start the step-out of a PN code in a receiving station, service area SE, A main control part (not shown) gives the dignity control information for making transmission power of a pilot channel larger than the transmission power of other broadcasting channels to the weight control section 40A. Therefore, the weight control section 40A makes the weighting factor given to the dignity multiplication section 30 for pilot channels a bigger value than the weighting factor given to the dignity multiplication sections 31-3N of other channels in this case. For this reason, CDM multiplexing is set up and carried out and the power value (amplitude) of a pilot signal is transmitted to a bigger value than the broadcast data of other channels.

[0037]Therefore, even when a multipass exists in the place generated mostly, the

receiving stations MS1-MSm in service area SE hold the resolution of a multipass highly, and it becomes possible to be established certainly and to maintain the synchronization to a PN code.

[0038]When a paid broadcasting channel is in two or more above-mentioned broadcasting channels, a main control part gives the dignity control information for making transmission power of this paid broadcasting channel larger than other free broadcast channels to the weight control section 40A. Therefore, a bigger weighting factor than others is given only to the dignity multiplication section 3i for paid broadcasting channels from the weight control section 40A to each dignity multiplication sections 31-3N for broadcasting channels, and, as a result, a paid broadcasting channel is transmitted with bigger transmission power than other free broadcast channels.

[0039]Therefore, when separated comparatively distantly [BS / broadcasting station], or even when the receiving stations MS1-MSm are in the place where receiving quality deteriorates easily like the inside of a building, at least about a paid broadcasting channel, it becomes possible to receive in good quality.

[0040]When the emergency intelligence about a disaster etc. needs to be broadcast, a main control part gives dignity control information only for the period which transmits this emergency intelligence to make transmission power of that broadcasting channel larger than other channels to the weight control section 40A. Therefore, to each dignity multiplication sections 31-3N for broadcasting channels, it restricts to the transmission period of the above-mentioned emergency intelligence from the weight control section 40A, and a bigger weighting factor than others is given only to the dignity multiplication section 3j of the broadcasting channel. For this reason, it restricts to the transmission period of the above-mentioned emergency intelligence, and that broadcasting channel is transmitted with bigger transmission power than other broadcasting channels.

[0041]Therefore, when separated comparatively distantly [BS / broadcasting station], or even when the receiving stations MS1-MSm are in the place where receiving quality deteriorates easily like the inside of a building, it becomes possible to receive the above-mentioned emergency intelligence certainly in good quality at least.

[0042]When there is a broadcasting channel which has non-broadcasting-hours belts, such as night, for example, the dignity control information for setting the transmission power in the non-broadcasting-hours belt of this broadcasting channel as the minimum power value (for example, zero) is given to the weight control section 40A from a main control part. For this reason, if it becomes the above-mentioned non-broadcasting-hours belt, the transmission power of the broadcasting channel concerned will be set as zero. Therefore, on the above-mentioned non-broadcasting-hours belt, the substantial broadcasting channel multiplexed number of a system can be reduced, and the receiving quality of each channel which is broadcasting by this can be improved on it.

[0043]Like the channel which broadcasts a pilot channel, a paid broadcasting channel, and emergency intelligence as having stated above by a 1st embodiment, When the specific channel which needs to make information receive for high quality is in the receiving stations MS1-MSm, A bigger weighting factor than others is given from the weight control section 40A to the dignity multiplication section corresponding to the specific channel concerned, and he carries out multiplication to send data, and is trying only for a required period to set the transmission power of a specific channel as a bigger value than the transmission power of other channels by this. Therefore, the receiving

quality can be improved about the channel of a specific use, without reducing a channel multiplexed number.

[0044](A 2nd embodiment) A 2nd embodiment of this invention, In [notify the number of the channel which is a reception schedule during reception from each receiving station to a broadcasting station, and] a broadcasting station, On a basis the channel designator under receiving selection notified from each receiving station The reception rate for every channel, That is, it asks for viewership or an audience rating, and it is made to carry out dignity control so that a reception rate may make transmission power of the high channel of a reception rate a bigger value than the transmission power of a channel lower than it based on this reception rate.

[0045]Drawing 3 (a) and (b) is a circuit block figure showing the composition of the broadcasting station of a digital broadcast system, and a receiving station concerning a 2nd embodiment of this invention. In the figure, identical codes are given to said drawing 2 (a), (b), and identical parts, and detailed explanation is omitted.

[0046]The receiving stations MS1-MSm are first provided with the following.

About the number of the channel under receiving selection, the time of a channel selection, or in order to notify to broadcasting station BS periodically, it is the modulation part 118B.

RF section 111B provided with the transmission system.

The modulation part 118B modulates the notice data containing the channel designator under selection outputted from the channel selection part 114 with digital modulation methods, such as a QPSK method, and supplies the signal after these abnormal conditions to RF section 111B. After RF section 111B carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards broadcasting station BS from the antenna 110. As the above-mentioned going-up channel, the communications channel of a portable telephone system or PHS (Personal Handyphone System) may be used, for example.

[0047]On the other hand, broadcasting station BS is provided with RF section 70B and the demodulation section 90 provided with the receiving system, in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 70B receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 90. The demodulation section 90 reproduces notice data by carrying out QPSK demodulation of the above-mentioned input signal.

[0048]Broadcasting station BS is provided with the weight control section 40B which operates according to the channel reception rate calculation part 100 and its computed result. The channel reception rate calculation part 100 based on the channel designator under receiving selection notified with notice data from each receiving stations MS1-MSm, This broadcasting channel is asked for the number of the receiving stations under receiving selection for every broadcasting channel, and it computes from that value, the viewership or the audience rating, i.e., the reception rate, for every broadcasting channel.

[0049]The weight control section 40B enlarges transmission power of a broadcasting channel with many receiving stations under present receiving selection according to the

computed result of the above-mentioned reception rate, The weighting factor for every broadcasting channel is set up so that the receiving station under present receiving selection may make transmission power of few broadcasting channels small instead, and this weighting factor is given to the dignity multiplication sections 31-3N. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 60.

[0050]Since it is such composition, if a user performs selection operation of a channel in each receiving stations MS1-MSm, After the notice data containing this selected channel designator is inputted into the modulation part 118B from the channel selection part 114 and QPSK modulation is carried out by this modulation part 118B, it goes up from RF section 111B, and is transmitted towards broadcasting station BS via a channel.

[0051]On the other hand, by broadcasting station BS, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 70B, it will get over by the demodulation section 90, notice data will be reproduced, and it will be inputted into the channel reception rate calculation part 100. In the channel reception rate calculation part 100, whenever notice data comes from the receiving stations MS1-MSm, the reception rate for every channel is recalculated based on the channel designator inserted in this notice data, and the calculation result of this reception rate is notified to the weight control section 40B.

[0052]The weight control section 40B computes the new weighting factor for every channel based on the calculation result of the above-mentioned reception rate. For example, now, the reception rate of broadcasting channel Ch#i increases remarkably, and presupposes that the reception rate of broadcasting channel Ch#j fell. If it does so, the weight control section 40B changes a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase, and it will change a weighting factor into a small value in order to reduce the transmission power of broadcasting channel Ch#j on the contrary.

[0053]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 31-3N according to this weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards service area SE from RF section 70B, after being normalized so that it may multiplex by the multiplex section 50 and the total electric power may become fixed by the electric power normalizing part 60.

[0054]If it is a 2nd embodiment, corresponding [therefore,] to the reception rate, i.e., the viewership, or audience rating of each broadcasting channel, Since transmission power is enlarged as a high channel and it was made for a reception rate to reduce transmission power relatively about a channel with a reception rate low on the contrary, Even when there are many channel multiplexed numbers and generating of interchannel interference is not avoided, many receiving station users become possible [receiving broadcast data with high quality].

[0055]When there is a broadcasting channel without the receiving station under reception, i.e., the broadcasting channel of a reception rate "0", in the weight control section 40B, the weighting factor to the broadcasting channel concerned is set as "0", and, as a result, the transmission power of the above-mentioned broadcasting channel is set to

"0." Therefore, it becomes possible to heighten the transmission power of a broadcasting channel besides the part, and the receiving quality of the receiving station which has received these broadcasting channels can be improved.
[0056](A 3rd embodiment) A 3rd embodiment of this invention, In [in each receiving station, detect the receiving quality of the channel under receiving selection, notify the detection result to a broadcasting station, and] a broadcasting station, The receiving station with which it is satisfied of predetermined receiving quality for every channel based on the detection result of the receiving quality notified from each above-mentioned receiving station comparatively, That is, it asks for a receiving quality satisfaction rate, and controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than the transmission power of the channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.
[0057]Drawing 4 (a) and (b) is a circuit block figure showing the composition of the broadcasting station of a digital broadcast system, and a receiving station concerning a 3rd embodiment of this invention. In the figure, identical codes are given to said drawing 3 (a), (b), and identical parts, and detailed explanation is omitted.
[0058]The receiving stations MS1-MSm are first provided with the following.
In order to notify BER which was provided with the BER test section 119 which carries out digital error rate (BER:Bit Error Rate) measurement, and was measured further to broadcasting station BS with the channel designator under receiving selection, it is the modulation part 118C.
RF section 111C provided with the transmission system.

[0059]The modulation part 118C modulates the notice data containing BER measured by the above-mentioned BER test section 119 and the channel designator under receiving selection outputted from the channel selection part 114 with digital modulation methods, such as a QPSK method, and supplies the signal after these abnormal conditions to RF section 111C. After RF section 111C carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards broadcasting station BS from the antenna 110. As the above-mentioned going-up channel, the communications channel of a portable telephone system or PHS (Personal Handyphone System) may be used like said 3rd embodiment, for example.
[0060]On the other hand, broadcasting station BS is provided with RF section 70C and the demodulation section 90 provided with the receiving system, in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 70C receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 90. The demodulation section 90 reproduces notice data by carrying out QPSK demodulation of the above-mentioned input signal.
[0061]Broadcasting station BS is provided with the weight control section 40C which operates according to the receiving quality satisfaction rate calculation part 101 and its computed result. Based on the channel designator and BER under receiving selection

notified with notice data from each receiving stations MS1-MSm, the receiving station with which it is satisfied of predetermined receiving quality for every broadcasting channel is comparatively got blocked, and the receiving quality satisfaction rate calculation part 101 asks for a receiving quality satisfaction rate.
[0062]According to the computed result of the above-mentioned reception rate, a receiving quality satisfaction rate enlarges transmission power of a broadcasting channel lower than a reference value, and the weight control section 40C controls it for more than the margin whose receiving quality satisfaction rate is more nearly constant than a reference value to make transmission power of a high broadcasting channel into a small value on the contrary. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 60.
[0063]Since it is such composition, in each receiving stations MS1-MSm. After being inserted in notice data with the channel designator which BER measured by the BER test section 119 is receiving, being inputted into the modulation part 118C and carrying out QPSK modulation by this modulation part 118C during reception, it goes up from RF section 111C, and is transmitted towards broadcasting station BS via a channel.
[0064]On the other hand, by broadcasting station BS, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 70C, it will get over by the demodulation section 90, notice data will be reproduced, and it will be inputted into the receiving quality satisfaction rate calculation part 101. In the receiving **** satisfaction rate calculation part 101, whenever notice data comes from the receiving stations MS1-MSm, The receiving quality satisfaction rate for every channel is calculated based on the number of BER inserted in this notice data, and its channel, and the calculation result of this receiving quality satisfaction rate is notified to the weight control section 40C.
[0065]The weight control section 40C computes the new weighting factor for every broadcasting channel based on the calculation result of the above-mentioned receiving quality satisfaction rate. For example, the receiving quality satisfaction rate of broadcasting channel Ch#i presupposes that it fell from the reference value now. If it does so, the weight control section 40C will change a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase. On the other hand, suppose that more than the margin with a constant receiving quality satisfaction rate of broadcasting channel Ch#j became high. In this case, a weighting factor is changed into a small value in order to reduce the transmission power of broadcasting channel Ch#j.
[0066]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 31-3N according to this weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards service area SE from RF section 70C, after being normalized so that it may multiplex by the multiplex section 50 and the total electric power may become fixed by the electric power normalizing part 60.
[0067]Therefore, it is increased by the transmission power of a broadcasting channel with many receiving stations in service area SE are not satisfied with receiving quality of receiving stations, and, as a result, the receiving quality of the broadcasting channel

concerned improves.
[0068]Also in this embodiment, about a broadcasting channel without the receiving station under reception, in the weight control section 40C, the weighting factor to the broadcasting channel concerned is set as "0", and, as a result, the transmission power of the above-mentioned broadcasting channel is set to "0." Therefore, it becomes possible to heighten the transmission power of a broadcasting channel besides the part, and the receiving quality of the receiving station which has received these broadcasting channels can be improved.
[0069](A 4th embodiment) A 4th embodiment of this invention, Have two or more relay stations which constitute a cell, and it multiplexes by carrying out diffusion treatment of the information on two or more channels distributed from the broadcasting station with a spread code different, respectively, Towards two or more receiving stations which exist in the cell which a local station covers, are this CDM multiplexed signal in the digital broadcast system which carries out wireless transmission, and each of two or more above-mentioned receiving stations, In [go up a self position register with a relay station via a channel, and detect the receiving quality of the channel under receiving selection, notify the detection result to a relay station, and] a relay station, The receiving station with which it is satisfied of predetermined receiving quality for every channel based on the detection result of the receiving quality notified from each above-mentioned receiving station comparatively, That is, it asks for a receiving quality satisfaction rate, and controls to make transmission power of a channel with a low receiving quality satisfaction rate into a bigger value than the transmission power of the channel whose receiving quality satisfaction rate is higher than it based on this receiving quality satisfaction rate.
[0070]Drawing 5 is an outline lineblock diagram of the digital broadcast system concerning a 4th embodiment of this invention. Two or more relay stations (the case of three games is illustrated in the figure) RS1-RS3 are distributed and allocated in the service area which a system covers. It is connected to broadcast main station BSS via a wire circuit, respectively, and these relay stations RS1-RS3 receive the data of each same broadcasting channel distributed from broadcast main station BSS. And CDM multiplex [of the data of these broadcasting channels] is carried out with a pilot signal, and it transmits to the relay service areas RE1-RE3 which self forms, respectively. Each receiving stations MS1-MSm receive a broadcasting signal with the most sufficient receiving quality selectively among the broadcasting signals which come from each relay stations RS1-RS3.
[0071]It is also possible between broadcast main station BSS and each relay stations RS1-RS3 to connect via a wireless circuit in addition to a wire circuit.
[0072]Drawing 6 (a) and (b) is a circuit block figure showing the important section composition of the above-mentioned relay stations RS1-RS3 and the receiving stations MS1-MSm, respectively. Identical codes are given to said drawing 5 (b) and identical parts among the composition of the receiving stations MS1-MSm, and detailed explanation is omitted.
[0073]The relay stations RS1-RS3 have two or more CDM modulation parts 220-22N first like broadcasting station BS described by said drawing 2 (a), Two or more broadcasting channel Ch#1 which received from said broadcast main station BSS - the broadcast data of Ch#N are inputted into these CDM modulation parts 220-22N as the pilot signal generated from the pilot signal generating part 210, respectively. A pilot

signal is a known signal used in order to establish the synchronization of a spread code in the receiving stations MS1-MSm, for example, consists of a signal pattern of an oar "1." moreover -- there are what consists of a picture and a sound, a thing which consists only of sounds, and a thing which consists of alphabetic data in each channel Ch#1 - the broadcast data of Ch#N -- the type of these data -- a channel -- or it is chosen by the time zone.

[0074]After each CDM modulation parts 220-22N perform primary abnormal conditions with digital modulation methods, such as a QPSK method, to the pilot signal and the broadcast data of each channel which were inputted, respectively, they carry out the multiplication of the PN code changed for every channel, and diffuse a zone. The numerals which carried out the multiplication of the orthogonal codes, such as Walsh numerals for securing the orthogonality between channels to long codes which are easy to establish the synchronization of a spread code, such as an M sequence with a long cycle, as a PN code, are used. The Walsh numerals of an oar "0" are used as an object for pilot signals.

[0075]The data modulated by the above-mentioned CDM modulation parts 220-22N is inputted into the dignity multiplication sections 230-23N, respectively. The dignity multiplication sections 230-23N carry out the multiplication of the weighting factor given to the modulation data outputted from the above-mentioned CDM modulation parts 220-22N from the weight control section 240.

[0076]The multiplex section 250 consists of adding machines, adds the modulation data after weighting outputted from the above-mentioned dignity multiplication sections 230-23N, and outputs the CDM modulation data after this addition to the electric power normalizing part 260. The electric power normalizing part 260 is normalized so that the electric power (amplitude) of the CDM modulation data outputted from the above-mentioned multiplex section 250 may be set to a constant level according to the normalized information given from the above-mentioned weight control section 240.

[0077]The wireless section (RF section) 270 changes into radio transmission wave frequency the CDM modulation data outputted from the above-mentioned electric power normalizing part 260, and after it band-limits, it transmits towards a service area from the antenna 280.

[0078]By the way, the relay stations RS1-RS3 of this embodiment are provided with RF section 270 and the demodulation section 290 provided with the receiving system in order to receive notice data from the above-mentioned receiving stations MS1-MSm. After RF section 270 receives the radio frequency signal which came via the above-mentioned going-up channel from each receiving stations MS1-MSm, frequency conversion of it is carried out to an intermediate frequency signal or a baseband signal, and it inputs the input signal after this conversion into the demodulation section 290. The demodulation section 290 reproduces notice data by carrying out QPSK demodulation of the above-mentioned input signal.

[0079]The relay stations RS1-RS3 are provided with the weight control section 240 which operates according to the receiving quality satisfaction rate calculation part 300 and its computed result. The receiving quality satisfaction rate calculation part 300 based on the channel designator and BER under receiving selection notified with notice data from the receiving station which has received the broadcasting channel of a local station among each receiving stations MS1-MSm, The receiving station with which it is satisfied

of predetermined receiving quality for every broadcasting channel is comparatively got blocked, and it asks for a receiving quality satisfaction rate.
[0080]According to the computed result of the above-mentioned receiving quality satisfaction rate, a receiving quality satisfaction rate enlarges transmission power of a broadcasting channel lower than a reference value, and the weight control section 240 controls it for more than the margin whose receiving quality satisfaction rate is more nearly constant than a reference value to make transmission power of a high broadcasting channel into a small value on the contrary. With it, in order to hold uniformly the total electric power after channel multiplex [which is fluctuated with the set-up dignity / all the], normalized information is given to the electric power normalizing part 260.
[0081]Furthermore, the relay stations RS1-RS3 are provided with the receiving station registration control section 310. The receiving station registration control section 310 creates the list of receiving stations which exist in the relay service areas RE1-RE3 of a local station based on the identification number of the receiving station of the transmitting origin included in the above-mentioned notice data which was gone up from the receiving stations MS1-MSm, and was received via the channel. In the above-mentioned receiving quality satisfaction rate calculation part 300, this list is used in order to compute the receiving quality satisfaction rate by the receiving station which has received the broadcasting channel of a local station.
[0082]The receiving station registration control section 310 also has a function which notifies the identification number of a local station to the receiving stations MS1-MSm. That is, the identification number of a local station is given to the above-mentioned notice data pilot signal generating part 210, and thereby, the identification number of a local station is inserted in a part of pilot signal, and it is made to transmit to it.
[0083]On the other hand, the receiving stations MS1-MSm are provided with the following.
The BER test section 119 which measures BER of the broadcasting channel under reception.
Registration control section 120.
The registration control section 120 extracts and holds the identification number of the relay station RSi of a transmitting agency from the largest pilot signal of the receiving level detected by the code synchronization part 113. And in order to register a local station to the relay station RSi under this reception, the identification number of the relay station which extracted [above-mentioned], and the identification number of a local station are given to the modulation part 118D.
[0084]The modulation part 118D creates the notice data containing BER measured by the above-mentioned BER test section 119, the channel designator under receiving selection outputted from the channel selection part 114, the identification number of the relay station RSi which the local station given from the above-mentioned registration control section 120 is receiving, and the identification number of a local station. And this notice data is modulated with digital modulation methods, such as a QPSK method, and the signal after these abnormal conditions is supplied to RF section 111D. After RF section 111D carries out frequency conversion of the above-mentioned modulating signal to the radio transmission wave frequency for predetermined going-up channels, it is amplified and transmits towards the relay station RSi under reception from the antenna 110.
[0085]Since it is such composition, when beginning to receive the broadcasting channel

from the arbitrary relay stations RSi, BER of the broadcasting channel under this reception is measured by the BER test section 119 during reception in each receiving stations MS1-MSm. And after the measured value of this BER is inserted in notice data with the number of the broadcasting channel under reception, and is inputted into the modulation part 118D and QPSK modulation is carried out by this modulation part 118D, it goes up from RF section 111D, and is transmitted towards the relay station RSi via a channel. In that case, the identification number of the relay station RSi under above-mentioned reception extracted by the registration control section 120 and the identification number of a local station are inserted and transmitted to the above-mentioned notice data.

[0086]On the other hand, in the relay station RSi, if a radio frequency signal comes from the receiving stations MS1-MSm, after this radio frequency signal is received by RF section 270, it will get over by the demodulation section 290, notice data will be reproduced, and it will be inputted into the receiving quality satisfaction rate calculation part 300 and the receiving station registration control section 310, respectively. In the receiving station registration control section 310, ********** extraction of the number of the relay station which serves as a transmission destination, and the identification number of the receiving station of a transmitting agency is carried out from the notice data which came from each receiving station. And the list of receiving stations while receiving the broadcasting channel which the local station has transmitted based on these identification numbers is created.

[0087]Whenever notice data comes, transmitting [the notice data concerned] origin judges the receiving **** satisfaction rate calculation part 300 based on the list created [whether it is a receiving station while receiving the broadcasting channel which the local station has transmitted, and] by the above-mentioned receiving registration control section 310. And if transmitting [notice data] origin is a receiving station while receiving the broadcasting channel which the local station has transmitted, it will compute the receiving quality satisfaction rate for every channel based on the number of BER inserted in the notice data concerned, and its channel, and will notify the calculation result of this receiving quality satisfaction rate to the weight control section 240.

[0088]The weight control section 240 computes the new weighting factor for every broadcasting channel based on the calculation result of the above-mentioned receiving quality satisfaction rate. For example, the receiving quality satisfaction rate of broadcasting channel Ch#i presupposes that it fell from the reference value now. If it does so, the weight control section 240 will change a weighting factor into a large value so that it may make the transmission power of broadcasting channel Ch#i increase. On the other hand, suppose that more than the margin with a constant receiving quality satisfaction rate of broadcasting channel Ch#j became high. In this case, a weighting factor is changed into a small value in order to reduce the transmission power of broadcasting channel Ch#j.

[0089]Thus, change of the weighting factor of each broadcasting channel Ch#1 - Ch#N will change the power value (amplitude) of the modulation data of each broadcasting channel Ch#1 outputted from the dignity multiplication sections 231-23N according to this weighting factor - Ch#N. And the modulation data into which this power value was changed is transmitted towards the relay service area REi from RF section 270, after being normalized so that it may multiplex by the multiplex section 250 and the total

electric power may become fixed by the electric power normalizing part 260.
[0090]Therefore, it is increased by the transmission power of a broadcasting channel with many receiving stations with which it is not satisfied of receiving quality every relay service areas RE1-RE3, and, as a result, the receiving quality of the broadcasting channel concerned improves.
[0091]This invention is not limited to each above-mentioned embodiment. For example, by said 4th embodiment, in each relay stations RS1-RS3, the receiving quality satisfaction rate for every [by each receiving station which has received the broadcasting channel from a local station] channel was computed, respectively, and the case where variable control of the transmission power of each broadcasting channel was carried out based on this receiving quality satisfaction rate was described. However, not only in this but in each relay stations RS1-RS3, the reception rate for every [by each receiving station which has received the broadcasting channel from a local station] broadcasting channel is computed, respectively, and it may be made to carry out variable control of the transmission power of each broadcasting channel based on this reception rate.
[0092]In each relay stations RS1-RS3 shown in a 4th embodiment, like a pilot channel, a paid broadcasting channel, and the channel that broadcasts emergency intelligence, respectively, When the specific channel which needs to make information receive for high quality is in the receiving stations MS1-MSm, A bigger weighting factor than others is given from the weight control section 240 to the dignity multiplication section corresponding to the specific channel concerned, multiplication is carried out to send data, and it may be made only for a required period to set the transmission power of a specific channel as a bigger value than the transmission power of other channels by this.
[0093]In addition, about the circuitry of a broadcasting station, a relay station, and a receiving station, the transmission-power-control procedure for every channel, its contents, etc., in the range which does not deviate from the gist of this invention, it changes variously and can carry out.

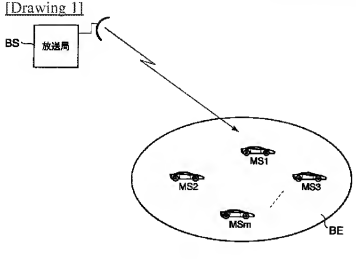
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The outline lineblock diagram of the digital broadcast system concerning a 1st embodiment of this invention.
[Drawing 2]The circuit block figure showing the important section composition of the broadcasting station of a system, and a receiving station shown in drawing 2.
[Drawing 3]The circuit block figure showing the important section composition of a broadcasting station and a receiving station concerning a 2nd embodiment of this invention.
[Drawing 4]The circuit block figure showing the important section composition of a broadcasting station and a receiving station concerning a 3rd embodiment of this invention.
[Drawing 5]The outline lineblock diagram of the digital broadcast system concerning a 4th embodiment of this invention.
[Drawing 6]The circuit block figure showing the important section composition of the broadcasting station of a system, and a receiving station shown in drawing 5.

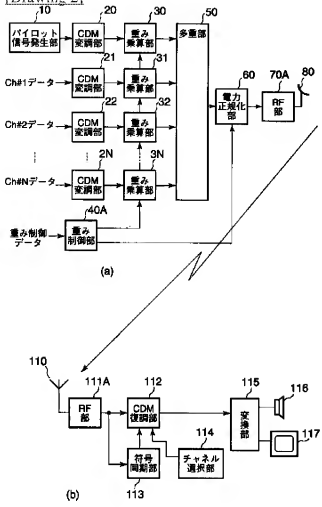
[Description of Notations]
BS -- Broadcasting station
BE -- Service area
MS1-MSm -- Receiving station
BSS -- Broadcast main station
RS1-RS3 -- Relay station
RE1-RE3 -- Relay service area
10,210 -- Pilot signal generating part
20-2N, 220 - 22 N--CDM modulation part
30-3N, 330-33N -- Dignity multiplication section
40A, 40B, 40C, 240 -- Weight control section
50,250 -- Multiplex section
60,260 -- Electric power normalizing part
70A, 70B, 70C, 270 -- RF section
80,280 -- Antenna
90,290 -- Demodulation section
101,300 -- Receiving quality satisfaction rate calculation part
110 -- Antenna of a receiving station
111A -- RF section
112 -- CDM demodulation section
113 -- Code synchronization part
114 -- Channel selection part
115 -- Converter
116 -- Loudspeaker
117 -- Indicator
118B, 118C, 118D -- Modulation part
119 -- BER test section
120 -- Registration control section
310 -- Receiving station registration control

DRAWINGS

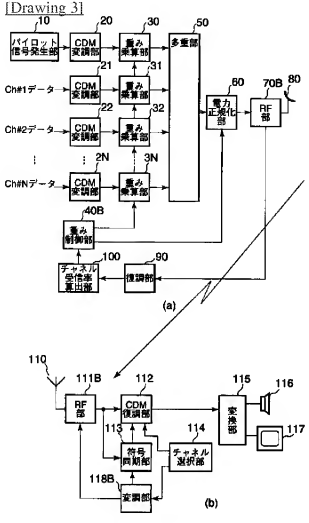
[Drawing 1]



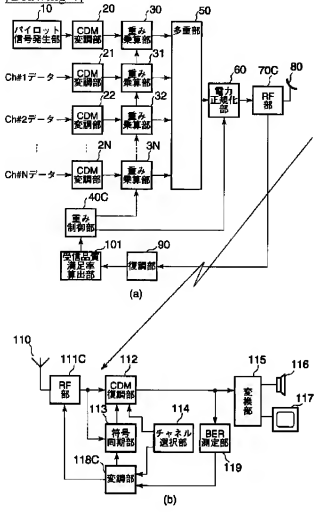
[Drawing 2]


10
20
30
50
パイロット信号発生部
CDM変調部
重み乗算部
多重部
21
31
Ch#1データ
CDM変調部
重み乗算部
60
70A
80
電力正規化部
RF部
22
32
Ch#2データ
CDM変調部
重み乗算部
2N
3N
Ch#Nデータ
CDM変調部
重み乗算部
40A
重み制御データ
重み制御部
(a)
110
111A
112
115
116
RF部
CDM復調部
変換部
114
117
符号同期部
チャネル選択部
(b)
113

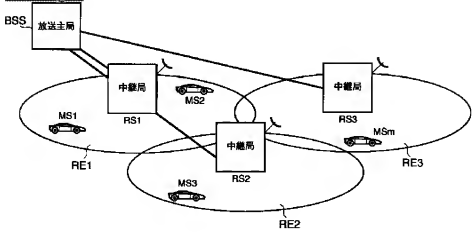
[Drawing 3]


10
パイロット信号発生部
20
CDM変調部
30
乗算部
50
多重部
21
31
Ch#1データ
22
32
Ch#2データ
2N
3N
Ch#Nデータ
60
電力正規化部
70B
80
RF部
40B
乗算制御部
100
チャネル受信状態算出部
90
復調部
(a)
110
111B
RF部
112
CDM復調部
115
116
113
114
117
符号同期部
チャネル選択部
118B
変調部
(b)

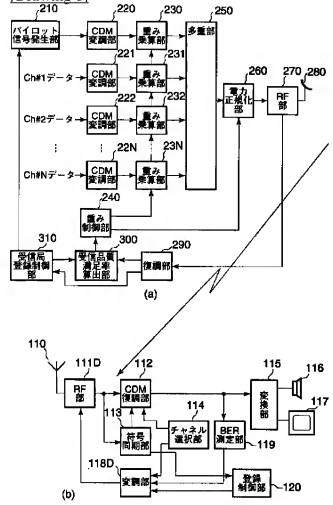
[Drawing 4]



[Drawing 5]



[Drawing 6]


210
220
230
250
パイロット信号発生部
CDM変調部
重み乗算部
多重部
221
231
Ch#1データ
CDM変調部
重み乗算部
222
232
Ch#2データ
CDM変調部
重み乗算部
22N
23N
ChNデータ
CDM変調部
重み乗算部
260
270
280
電力正規化部
RF部
240
重み制御部
310
300
290
受信局数制御部
受信品質測定値算出部
復調部
(a)
110
111D
112
115
116
RF部
CDM復調部
音声部
113
114
117
符号同期部
チャネル選択部
BER測定部
119
118D
変調部
登録制御部
120
(b)

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号
特開2002－94393
（P2002－94393A）
(43)公開日　平成14年３月29日(2002.3.29)

(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード（参考）
Ｈ０４Ｂ　1/04		Ｈ０４Ｂ　1/04	Ｅ	５Ｋ０２２
Ｈ０４Ｈ　1/00		Ｈ０４Ｈ　1/00	Ｕ	５Ｋ０４７
Ｈ０４Ｊ　13/04		Ｈ０４Ｌ　7/00	Ｃ	５Ｋ０６０
Ｈ０４Ｌ　7/00		Ｈ０４Ｊ　13/00	Ｇ	

審査請求　未請求　請求項の数15　ＯＬ　（全 13 頁）

(21)出願番号　特願2000－283911(P2000－283911)

(22)出願日　平成12年９月19日(2000.9.19)

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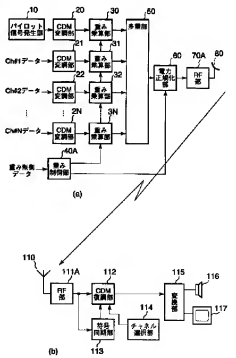
Ｆターム(参考)　5K022 EE02 EE13 EE21 EE36
5K047 AA01 CC01 CC08 EE02 GG34 HH15
5K060 BB07 CC04 DD03 FF00 HH06 LL01

(54)【発明の名称】　ディジタル放送システムとその送信局及び中継局

(57)【要約】
【課題】　チャネル多重数を減らすことなく特定の用途のチャネルについてその受信品質を改善する。
【解決手段】　パイロットチャネルや有料放送チャネル、緊急情報を放送するチャネル等のように、受信局ＭＳ１～ＭＳｍに高品質で情報を受信させる必要がある特定のチャネルがある場合に、重み制御部４０Ａから当該特定チャネルに対応する重み乗算部に対し他より大きな重み係数を与えて送信データに乗算させ、これにより特定チャネルの送信電力を必要期間のみ他のチャネルの送信電力より大きな値に設定するようにしたものである。



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【特許請求の範囲】

【請求項１】　複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化後の信号を複数の受信局に向けて無線送信するディジタル放送用送信局において、

前記各チャネルの用途に応じてチャネルごとの送信電力を個別に可変設定する送信電力制御手段を具備したことを特徴とするディジタル放送用送信局。

【請求項２】　前記複数のチャネルの中に前記各受信局が位相符号同期を確立するために使用するパイロットチャネルが含まれている場合に、

前記送信電力制御手段は、このパイロットチャネルの送信電力を他のチャネルの送信電力より大きくすることを特徴とする請求項１記載のディジタル放送用送信局。

【請求項３】　前記複数のチャネルの中に、無料放送チャネルと有料放送チャネルとが含まれている場合に、

前記送信電力制御手段は、前記有料放送チャネルの送信電力を無料放送チャネルの送信電力より大きくすることを特徴とする請求項１記載のディジタル放送用送信局。

【請求項４】　前記複数のチャネルの中に、所定の重要度を有する情報を送信する第１のチャネルと、この第１のチャネルにより送信される情報より重要度の高い情報を送信する第２のチャネルとが含まれている場合に、

前記送信電力制御手段は、前記第２のチャネルの送信電力を第１のチャネルの送信電力より大きくすることを特徴とする請求項１記載のディジタル放送用送信局。

【請求項５】　前記送信電力制御手段は、前記第２のチャネルの送信電力を、前記重要度の高い情報を送信している期間のみ第１のチャネルの送信電力より大きくすることを特徴とする請求項１記載のディジタル放送用送信局。

【請求項６】　前記送信電力制御手段は、各チャネルごとに送信すべき情報の有無を監視し、送信すべき情報がない期間に当該チャネルの送信電力を最小電力値に設定することを特徴とする請求項１記載のディジタル放送用送信局。

【請求項７】　前記送信電力制御手段による各チャネルに対する送信電力の制御結果をもとに、多重化後の信号の送信電力を一定に保持する電力正規化手段をさらに具備したことを特徴とする請求項１乃至６のいずれかに記載のディジタル放送用送信局。

【請求項８】　送信局において複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化後の信号を複数の受信局に向けて無線送信するディジタル放送システムにおいて、

前記複数の受信局の各々は、受信中又は受信予定のチャネルを示す情報を送信局に通知する受信チャネル通知手段を備え、

前記送信局は、

前記各受信局から通知された情報をもとに各チャネルごとの受信率を求める受信率算出手段と、

この受信率算出手段により算出された各チャネルの受信率に基づいて、受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを備えたことを特徴とするディジタル放送システム。

【請求項９】　複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を複数の受信局に向け無線送信するディジタル放送用送信局において、

前記各受信局から通知される受信中又は受信予定のチャネルを示す情報をもとに各チャネルごとの受信率を求める受信率算出手段と、

この受信率算出手段により算出された各チャネルの受信率に基づいて、受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを具備したことを特徴とするディジタル放送用送信局。

【請求項１０】　送信局において複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化後の信号を複数の受信局に向けて無線送信するディジタル放送システムにおいて、

前記複数の受信局の各々は、受信したチャネルの受信品質を検出してその検出結果を送信局に通知する受信品質通知手段を備え、

前記送信局は、

前記各受信局から通知された受信品質の検出結果をもとに、各チャネルごとに所定の受信品質を満足している受信局の割合を求める受信品質満足率算出手段と、

この受信品質満足率算出手段により算出された各チャネルの受信品質満足率に基づいて、受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを備えたことを特徴とするディジタル放送システム。

【請求項１１】　複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を複数の受信局に向け無線送信するディジタル放送用送信局において、

前記各受信局から通知された受信チャネルの受信品質検出結果をもとに、各チャネルごとに所定の受信品質を満足している受信局の割合を求める受信品質満足率算出手段と、

この受信品質満足率算出手段により算出された各チャネルの受信品質満足率に基づいて、受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを具備したことを特徴とするディジタル放送用送信局。

【請求項１２】　複数のチャネルの情報を配信する放送

局と、この放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を自局がカバーするサービスエリアに向け無線送信する複数の中継局と、これらの中継局が無線送信した多重化信号を受信して所望のチャネルの情報を再生する複数の受信局とを備えたディジタル放送システムであって、
前記複数の受信局の各々は、受信中又は受信予定のチャネルを示す情報を当該受信チャネルの送信元となる中継局に通知する受信チャネル通知手段を備え、
前記複数の中継局の各々は、
前記各受信局から通知された情報をもとに各チャネルごとの受信率を求める受信率算出手段と、
この受信率算出手段により算出された各チャネルの受信率に基づいて、受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを備えたことを特徴とするディジタル放送システム。
【請求項１３】　放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を自局がカバーするサービスエリアに存在する複数の受信局に向け無線送信するディジタル放送用中継局において、
前記各受信局から通知される受信中又は受信予定のチャネルを示す情報をもとに各チャネルごとの受信率を求める受信率算出手段と、
この受信率算出手段により算出された各チャネルの受信率に基づいて、受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを具備したことを特徴とするディジタル放送用中継局。
【請求項１４】　複数のチャネルの情報を配信する放送局と、この放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を自局がカバーするサービスエリアに向け無線送信する複数の中継局と、これらの中継局が無線送信した多重化信号を受信して所望のチャネルの情報を再生する複数の受信局とを備えたディジタル放送システムであって、
前記複数の受信局の各々は、受信したチャネルの受信品質を検出してその検出結果を当該受信チャネルの送信元となる中継局に通知する受信品質通知手段を備え、
前記複数の中継局の各々は、
前記各受信局から通知された受信品質の検出結果をもとに、各チャネルごとに所定の受信品質を満足している受信局の割合を求める受信品質満足率算出手段と、
この受信品質満足率算出手段により算出された各チャネルの受信品質満足率に基づいて、受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを備えたことを特徴とするディジタル放送システム。
【請求項１５】　放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を自局がカバーするサービスエリアに存在する複数の受信局に向け無線送信するディジタル放送用中継局において、
前記各受信局から通知されるチャネル受信品質の検出結果をもとに、各チャネルごとに所定の受信品質を満足している受信局の割合を求める受信品質満足率算出手段と、
この受信品質満足率算出手段により算出された各チャネルの受信品質満足率に基づいて、受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値に設定するための制御を行う送信電力制御手段とを具備したことを特徴とするディジタル放送用中継局。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、符号分割多重（ＣＤＭ：Code Division Multiplex）方式を採用したディジタル放送システムとその送信局装置に関する。
【０００２】
【従来の技術】近年、ＣＤＭ方式を採用したディジタル放送システムが注目されている。ＣＤＭ方式を採用したシステムは、スペクトラム拡散技術を使用するもので、例えば次のように構成される。
【０００３】すなわち、送信局は、各チャネルごとにディジタル化された音声データや画像データを先ず位相変調方式等のディジタル変調方式により一次変調する。次に、この変調された送信データを、チャネルごとに異なる拡散符号を用いてそれぞれスペクトラム拡散することにより広帯域の送信信号に変換し、この広帯域送信信号を合成して無線周波数の信号に変換したのち送信する。一方受信機は、受信した無線周波信号に対し、希望するチャネルに対応する拡散符号を用いてスペクトラム逆拡散を行なう。そして、この逆拡散により分離された受信信号に対し、位相復調方式等のディジタル復調方式により一次復調を行なって受信データを再生する。
【０００４】ＣＤＭ方式は、スペクトラム拡散技術を用いることで、フェージング等の無線環境の変化に対し受信品質を高く維持し易いという利点を有する。
【０００５】ところで、この種のシステムにおいて、決められた伝送帯域でより多くの情報を伝送する、すなわち周波数利用効率を上げるためには、チャネル多重数を増やす必要がある。しかしながら、チャネルの多重数を増やすと拡散符号の相互相関に上り、チャネル間で干渉が発生して受信品質の劣化を生じやすくなる。この問題は、緊急情報等の重要な情報を放送するチャネルにあっては特に好ましくなく、対策が切望されている。

【０００６】
【発明が解決しようとする課題】このようにＣＤＭ方式を採用したディジタル放送システムは、無線環境の変化に強いと云う利点を有する反面、チャネル多重数を増やした場合にチャネル間干渉を起こしやすくなって受信品質の劣化を招くという問題点を有する。
【０００７】この発明は上記事情に着目してなされたもので、その目的とするところは、チャネル多重数を減らすことなく特定の用途のチャネルについてその受信品質を改善するようにしたディジタル放送システムとその送信局及び中継局を提供することにある。
【０００８】
【課題を解決するための手段】上記目的を達成するために第１の発明は、複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化後の信号を複数の受信局に向けて無線送信するディジタル放送用送信局において、上記各チャネルの用途に応じてチャネルごとの送信電力を個別に可変設定する送信電力制御手段を設けたものである。
【０００９】上記送信電力制御手段の制御内容としては、例えば次のようなものが考えられる。
(1) 複数のチャネルの中に各受信局が拡散符号同期を確立するために使用するパイロットチャネルが含まれている場合に、送信電力制御手段により、このパイロットチャネルの送信電力を他のチャネルの送信電力より大きくする。
【００１０】(2) 複数のチャネルの中に、無料放送チャネルと有料放送チャネルとが含まれている場合に、送信電力制御手段により、上記有料放送チャネルの送信電力を無料放送チャネルの送信電力より大きくする。
【００１１】(3) 複数のチャネルの中に、所定の重要度を有する情報を送信する第１のチャネルと、この第１のチャネルにより送信される情報より重要度の高い情報を送信する第２のチャネルとが含まれている場合に、送信電力制御手段により、上記第２のチャネルの送信電力を第１のチャネルの送信電力より大きくする。その際、送信電力制御手段は、第２のチャネルの送信電力を、重要度の高い情報を送信している期間のみ第１のチャネルの送信電力より大きくする。
【００１２】(4) 送信電力制御手段により、各チャネルごとに送信すべき情報の有無を監視し、送信すべき情報が無い期間には当該チャネルの送信電力を最小電力値に設定する。
【００１３】従ってこの発明によれば、チャネルの用途に応じ、受信局に高い品質で情報を受信させる必要があるチャネルについては、他のチャネルより大きい送信電力により送信される。このため、チャネル多重数が増加してチャネル間干渉が起こりやすい状態であっても、受信局は特定の用途のチャネル、例えば同期確立に必要なパイロットチャネルや、有料放送チャネル、緊急情報等の重要な情報を放送するチャネルの受信品質を改善することができる。
【００１４】さらに電力正規化手段を設け、上記送信電力制御手段による各チャネルに対する送信電力の制御結果をもとに、多重化後の信号の送信電力を一定に保持することも特徴とする。このようにすることで、送信局の送信電力は常に許容範囲内に抑えられる。
【００１５】なお、上記送信局には放送局は勿論のこと、放送局から配信された情報をＣＤＭ多重して送信する中継局も含まれる。
【００１６】一方第２の発明は、各受信局から送信局に対し受信中又は受信予定のチャネルを示す情報を通知し、送信局において、各受信局から通知された上記情報をもとに各チャネルごとの受信率つまり視聴率又は聴取率を求め、この受信率に基づいて受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値とするように制御したものである。
【００１７】従ってこの発明によれば、受信率が高いチャネルの送信電力は他のチャネルよりも高い値に設定される。このため、前受信局ユーザのうちより多くの受信局ユーザが高品質の受信を行うことが可能となる。
【００１８】また第３の発明は、各受信局において受信チャネルの受信品質を検出してその検出結果を送信局にそれぞれ通知し、送信局において、上記各受信局から通知されたで受信品質の検出結果をもとに各チャネルごとに所定の受信品質を満足している受信局の割合（場所率とも云う）を求め、この受信品質満足率に基づいて受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値にするように制御したものである。
【００１９】従ってこの発明によれば、受信品質を満足している受信局の割合が基準値を下回っているチャネルについては送信電力が高い値に設定され、代わりに受信品質を満足している受信局の割合が基準値を上回っているチャネルについては送信電力が下げられる。すなわち、各チャネルの送信電力は、受信品質を満足している受信局の割合に応じて最適化されることになる。このため、特定のチャネルにおける極端な受信品質劣化を防止して、チャネル間での受信品質のばらつきを軽減することができる。
【００２０】さらに第４の発明は、中継局を備え、放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化信号を自局がカバーするサービスエリアに存在する複数の受信局に向け無線送信するディジタル放送システムにあって、上記複数の受信局の各々は、受信中又は受信予定のチャネルを示す情報、或いは受信したチャネルの受信品質を表す情報を当該受信チャネルの送信元となる中継局に通知する。これに対し上記複数の中継局の各々は、上記各受信局から通知された情報をもとに各チャ

ネルごとの受信率を求めるか、或いは通知された受信品質を表す情報をもとに各チャネルごとに所定の受信品質を満足している受信局の割合を求める。そして、この算出された各チャネルの受信率に基づいて、受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値に設定するための制御を行うか、或いは算出された各チャネルの受信品質満足率に基づいて、受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値に設定するための制御を行うようにしたものである。

【００２１】従ってこの発明によれば、例えばギャップフィラー用の中継局を備えているシステムにおいて、チャネルごとの受信率つまり視聴率や聴取率に応じて、或いはチャネルごとの所定の受信品質を満足している受信局の割合に応じて、中継局において各チャネルごとの送信電力が個別に可変制御される。このため、中継局を使用したシステムにおいても、チャネルごとの視聴率や聴取率に応じて、或いは受信品質満足率に応じて、最適な送信電力を行うことができる。

【００２２】

【発明の実施の形態】（第１の実施形態）この発明の第１の実施形態は、放送局において、チャネルの用途、例えばパイロット信号を送信するチャネルであるか、有料放送チャネルであるか、或いは重要情報を送信するチャネルであるかに応じて、各チャネルの送信電力を個別に可変設定するようにしたものである。

【００２３】図１は、この発明に係わるディジタル放送システムの第１の実施形態を示す概略構成図である。放送局ＢＳは、複数のチャネルの情報をＣＤＭ多重し、このディジタル多重化信号を自己がカバーするサービスエリアＢＥに向け無線送信する。複数の受信局ＭＳ１～ＭＳｍは、上記サービスエリアＳＥ内において上記放送局ＢＳが送信したディジタル多重化信号を受信する。そして、この受信したディジタル多重化信号をチャネルごとに分離したのち、ユーザが視聴又は聴取を希望するチャネルを選択して再生出力する。

【００２４】なお、上記ディジタル多重化信号は、放送局ＢＳから地上波により放送することも、また放送局ＢＳから放送衛星又は通信衛星を介して放送することも可能である。また各受信局ＭＳ１～ＭＳｍには、屋内外に固定的に設置されるタイプのものと、車両に搭載されるタイプのものと、ユーザが携帯するタイプのものがある。

【００２５】ところで、上記放送局ＢＳ及び各受信局ＭＳ１～ＭＳｍは次のように構成される。図２（ａ）及び（ｂ）はそれぞれその要部構成を示す回路ブロック図である。

【００２６】先ず放送局ＢＳは、複数のＣＤＭ変調部２０～２Ｎを有しており、これらのＣＤＭ変調部２０～２Ｎにはパイロット信号発生器１０から発生されたパイロット信号と、図示しない番組生成部から発生された複数の放送チャネルＣｈ＃１～Ｃｈ＃Ｎの放送データがそれぞれ入力される。パイロット信号は、受信局ＭＳ１～ＭＳｍで拡散符号の同期を確立するために使用する既知の信号であり、例えばオール“１”の信号パターンからなる。また、各チャネルＣｈ＃１～Ｃｈ＃Ｎの放送データには、画像と音声からなるもの、音声のみからなるもの、文字データからなるものがあり、これらのデータのタイプはチャネルにより或いは時間帯により選択される。

【００２７】各ＣＤＭ変調部２０～２Ｎはそれぞれ、入力されたパイロット信号及び各チャネルの放送データに対し、ＱＰＳＫ（Quadrature Phase Shift Keying）方式等のディジタル変調方式により一次変調を行ったのち、チャネルごとに異ならせたＰＮ（Pseudo random Noise）符号を乗算して帯域を拡散させる。ＰＮ符号としては、拡散符号の同期を確立し易い周期の長いＭ系列等のロングコードに、チャネル間の直交性を確保するためのWalsh符号等の直交符号を乗算した符号が用いられる。なお、パイロット信号用としては、オール“０”のWalsh符号が用いられる。

【００２８】上記ＣＤＭ変調部２０～２Ｎにより変調されたデータはそれぞれ重み乗算部３０～３Ｎに入力される。重み乗算部３０～３Ｎは、上記ＣＤＭ変調部２０～２Ｎから出力されたデータに、重み制御部４０Ａから与えられた重み係数を乗算する。重み制御部４０Ａは、図示しない主制御部から与えられた重み制御データに従い各チャネルごとの重み係数を設定し、この重み係数を上記各重み乗算部３０～３Ｎに与える。またそれと共に、上記各チャネルに設定した重みによって増減する全チャネル多重後の総電力を一定に保つべく、電力正規化部６０に正規化情報を与える。

【００２９】多重部５０は、加算器からなり、上記重み乗算部３０～３Ｎから出力された重み付け後の変調データを加算し、この加算後のＣＤＭ変調データを電力正規化部６０へ出力する。電力正規化部６０は、上記重み制御部４０Ａから与えられた正規化情報に従い、上記多重部５０から出力されたＣＤＭ変調データの電力（振幅）が一定レベルになるように正規化する。

【００３０】無線部（ＲＦ部）７０は、上記電力正規化部６０から出力されたＣＤＭ変調データを無線搬送波周波数に変換し、帯域制限を行ったのちアンテナ８０からサービスエリアに向け送信する。

【００３１】一方、受信局ＭＳ１～ＭＳｍは次のように構成される。すなわち、上記放送局ＢＳから到来した無線搬送波信号はアンテナ１１０で受信されたのち無線部（ＲＦ部）１１１Ａに入力される。ＲＦ部１１１Ａは、受信した無線周波信号に対し帯域制限を行ったのちベースバンド信号に周波数変換し、この受信ベースバンド信号をＣＤＭ復調部１１２及び符号同期部１１３にそれぞ

れ入力する。

【００３２】符号同期部１１３は、上記受信ベースバンド信号から、パイロットチャネルにより送られたパイロット信号をマッチドフィルタを用いて抽出し、その抽出結果をもとにＰＮ符号の同期タイミングを確立してこの同期タイミングをＣＤＭ復調部１１２に指示する。

【００３３】ＣＤＭ復調部１１２は、ＰＮ符号発生器を有し、チャネル選択部１１４によって選択指定された受信希望チャネルに対し１対１に対応するＰＮ符号を上記ＰＮ符号発生器から発生する。そして、このＰＮ符号を、上記符号同期部１１３から指示された同期タイミングで上記受信ベースバンド信号に乗算することにより逆拡散し、続いてこの逆拡散後の受信データに対し送信局の一次変調方式に対応した例えばＱＰＳＫ復調を行い、これにより上記受信希望チャネルの復調データを得る。

【００３４】この復調データは、そのデータ種別つまり画像であるか音声であるか、さらには文字データであるかによって、変換部１１５で所定の表示フォーマット或いは音声のフォーマットに変換されたのち、それぞれ表示器１１７及びスピーカ１１６に供給されて表示及び拡声出力される。

【００３５】次に、以上のように構成されたシステムの放送局ＢＳの動作を説明する。先ず、サービスエリアＳＥが、例えば田園地帯のようにマルチパスの発生が比較的少ない場所が多い場合には、放送局ＢＳの主制御部（図示せず）は各チャネルの送信電力を同一値に設定するための重み制御情報を重み制御部４０Ａに与える。従って、この場合重み制御部４０Ａは、パイロットチャネル用を含む全ての重み乗算部３０～３Ｎに対し同一値の重み係数を与える。このため、パイロット信号及び各チャネルの放送データには同一値の重み係数が乗算され、この結果パイロット信号及び各放送データは同一の送信電力でＣＤＭ多重化されて送信される。

【００３６】これに対しサービスエリアＳＥが、都市部等のようにマルチパスの発生が多く、受信局でＰＮ符号の同期外れを起こし易いエリアが多い場合には、主制御部（図示せず）はパイロットチャネルの送信電力を他の放送チャネルの送信電力より大きくするための重み制御情報を重み制御部４０Ａに与える。したがって、この場合重み制御部４０Ａは、パイロットチャネル用の重み乗算部３０に対し与える重み係数を、他のチャネルの重み乗算部３１～３Ｎに与える重み係数より大きな値とする。このため、パイロット信号の電力値（振幅）は他のチャネルの放送データより大きな値に設定され、ＣＤＭ多重化されて送信される。

【００３７】したがって、サービスエリアＳＥ内の受信局ＭＳ１～ＭＳｍは、マルチパスが多く発生する場所に存在する場合でも、マルチパスの分解能を高く保持してＰＮ符号に対する同期を確実に確立しかつ維持することが可能となる。

【００３８】また、上記複数の放送チャネルの中に有料放送チャネルがある場合には、主制御部はこの有料放送チャネルの送信電力を他の無料放送チャネルより大きくするための重み制御情報を重み制御部４０Ａに与える。したがって、重み制御部４０Ａから放送チャネル用の各重み乗算部３１～３Ｎへは、有料放送チャネル用の重み乗算部３ｉにのみ他よりも大きな重み係数が与えられ、この結果有料放送チャネルは他の無料放送チャネルより大きな送信電力で送信される。

【００３９】したがって受信局ＭＳ１～ＭＳｍは、放送局ＢＳから比較的遠く離れている場合や、ビル内等のように受信品質が劣化しやすい場所にいる場合でも、少なくとも有料放送チャネルについては良好な品質で受信することが可能となる。

【００４０】さらに、災害等に関する緊急情報を放送する必要が生じた場合には、主制御部はこの緊急情報を送信する期間のみその放送チャネルの送信電力を他のチャネルより大きくするための重み制御情報を重み制御部４０Ａに与える。したがって、重み制御部４０Ａから放送チャネル用の各重み乗算部３１～３Ｎへは、上記緊急情報の送信期間に限りその放送チャネルの重み乗算部３ｊにのみ他よりも大きな重み係数が与えられる。このため、上記緊急情報の送信期間に限りその放送チャネルは他の放送チャネルより大きな送信電力で送信される。

【００４１】したがって受信局ＭＳ１～ＭＳｍは、放送局ＢＳから比較的遠く離れている場合や、ビル内等のように受信品質が劣化しやすい場所にいる場合でも、少なくとも上記緊急情報を良好な品質で確実に受信することが可能となる。

【００４２】また、例えば夜間等の非放送時間帯を有する放送チャネルがある場合には、この放送チャネルの非放送時間帯における送信電力を最小電力値（例えばゼロ）に設定するための重み制御情報が、主制御部から重み制御部４０Ａに与えられる。このため、上記非放送時間帯になると当該放送チャネルの送信電力はゼロに設定される。したがって、上記非放送時間帯にはシステムの実質的な放送チャネル多重数を減らすことができ、これにより放送を行っている各チャネルの受信品質を改善することができる。

【００４３】以上述べたように第１の実施形態では、パイロットチャネルや有料放送チャネル、緊急情報を放送するチャネル等のように、受信局ＭＳ１～ＭＳｍに高品質で情報を受信させる必要がある特定のチャネルがある場合に、重み制御部４０Ａから当該特定チャネルに対応する重み乗算部に対し他より大きな重み係数を与えて送信データに乗算させ、これにより特定チャネルの送信電力を必要期間のみ他のチャネルの送信電力より大きな値に設定するようにしている。したがって、チャネル多重数を減らすことなく特定の用途のチャネルについてその受信品質を改善することができる。

【００４４】（第２の実施形態）この発明の第２の実施形態は、各受信局から放送局に対し受信中又は受信予定のチャネルの番号を通知し、放送局において、各受信局から通知された受信選択中のチャネル番号をもとに各チャネルごとの受信率、つまり視聴率又は聴取率を求め、この受信率に基づいて受信率の高いチャネルの送信電力を受信率がそれより低いチャネルの送信電力より大きな値とするように重み制御するようにしたものである。

【００４５】図３（ａ）及び（ｂ）は、この発明の第２の実施形態に係わるディジタル放送システムの放送局及び受信局の構成を示す回路ブロック図である。なお、同図において前記図２（ａ），（ｂ）と同一部分には同一符号を付して詳しい説明は省略する。

【００４６】先ず受信局ＭＳ１～ＭＳｍは、受信選択中のチャネルの番号をチャネル選択時又は定期的に放送局ＢＳに通知するために、変調部１１８Ｂと、送信系を備えたＲＦ部１１１Ｂとを備えている。変調部１１８Ｂは、チャネル選択部１１４から出力される選択中のチャネル番号を含む通知データを、ＱＰＳＫ方式等のディジタル変調方式により変調し、この変調後の信号をＲＦ部１１１Ｂに供給する。ＲＦ部１１１Ｂは、上記変調信号を所定の上りチャネル用の無線搬送波周波数に周波数変換したのち、増幅してアンテナ１１０から放送局ＢＳに向け送信する。なお、上記上りチャネルとしては、例えば携帯電話システムやＰＨＳ（Personal Handyphone System）の通信チャネルを使用してもよい。

【００４７】一方放送局ＢＳは、上記受信局ＭＳ１～ＭＳｍから通知データを受信するために、受信系を備えたＲＦ部７０Ｂ及び復調部９０を備えている。ＲＦ部７０Ｂは、各受信局ＭＳ１～ＭＳｍから上記上りチャネルを介して到来した無線周波信号を受信したのち中間周波信号又はベースバンド信号に周波数変換し、この変換後の受信信号を復調部９０に入力する。復調部９０は、上記受信信号をＱＰＳＫ復調することで通知データを再生する。

【００４８】また放送局ＢＳは、チャネル受信率算出部１００及びその算出結果に応じて動作する重み制御部４０Ｂを備えている。チャネル受信率算出部１００は、各受信局ＭＳ１～ＭＳｍから通知データにより通知された受信選択中のチャネル番号をもとに、各放送チャネルごとにこの放送チャネルを受信選択中の受信局の数を求め、その値から各放送チャネルごとの視聴率又は聴取率つまり受信率を算出する。

【００４９】重み制御部４０Ｂは、上記受信率の算出結果に応じて、現在受信選択中の受信局が多い放送チャネルの送信電力を大きくし、代わりに現在受信選択中の受信局が少ない放送チャネルの送信電力を小さくするべく、各放送チャネルごとの重み係数を設定し、この重み係数を重み乗算部３１～３Ｎに与える。またそれと共に、設定した重みにより増減する全チャネル多重後の総電力を一定に保持するために、電力正規化部６０に対し正規化情報を与える。

【００５０】このような構成であるから、各受信局ＭＳ１～ＭＳｍにおいてユーザがチャネルの選択操作を行うと、この選択されたチャネル番号を含む通知データがチャネル選択部１１４から変調部１１８Ｂに入力され、この変調部１１８ＢでＱＰＳＫ変調されたのちＲＦ部１１１Ｂから上りチャネルを介して放送局ＢＳに向け送信される。

【００５１】一方放送局ＢＳでは、受信局ＭＳ１～ＭＳｍから無線周波信号が到来すると、この無線周波信号がＲＦ部７０Ｂで受信されたのち復調部９０で復調されて通知データが再生され、チャネル受信率算出部１００に入力される。チャネル受信率算出部１００では、受信局ＭＳ１～ＭＳｍから通知データが到来するごとに、この通知データに挿入されているチャネル番号をもとに各チャネルごとの受信率が計算し直され、この受信率の計算結果が重み制御部４０Ｂに通知される。

【００５２】重み制御部４０Ｂは、上記受信率の計算結果をもとに各チャネルごとの新たな重み係数を算出する。例えば、いま放送チャネルＣｈ＃ｉの受信率が著しく増加し、放送チャネルＣｈ＃ｊの受信率が低下したとする。そうすると重み制御部４０Ｂは、放送チャネルＣｈ＃ｉの送信電力を増加させるべく重み係数を大きい値に変更し、反対に放送チャネルＣｈ＃ｊの送信電力を低下させるべく重み係数を小さい値に変更する。

【００５３】このように各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの重み係数が変更されると、この重み係数に応じて重み乗算部３１～３Ｎから出力される各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの変調データの電力値（振幅）が可変される。そして、この電力値が可変された変調データが、多重部５０で多重化されかつ電力正規化部６０で総電力が一定となるように正規化されたのち、ＲＦ部７０Ｂからサービスエリア内ＳＥに向け送信される。

【００５４】したがって第２の実施形態であれば、各放送チャネルの受信率つまり視聴率或いは聴取率に応じ、受信率が高いチャネルほど送信電力を大きくし、反対に受信率が低いチャネルについては送信電力を相対的に低下させるようにしたので、チャネル多重数が多くチャネル間干渉の発生が避けられない場合でも、多くの受信局ユーザは高品質に放送データを受信することが可能となる。

【００５５】なお、受信中の受信局がない放送チャネル、つまり受信率“０”の放送チャネルがあった場合には、重み制御部４０Ｂにおいて当該放送チャネルに対する重み係数が“０”に設定され、この結果上記放送チャネルの送信電力は“０”になる。したがって、その分他の放送チャネルの送信電力を高めることが可能となり、これらの放送チャネルを受信している受信局の受信品質を改善できる。

【００５６】（第３の実施形態）この発明の第３の実施形態は、各受信局において受信選択中のチャネルの受信品質を検出してその検出結果を放送局に通知し、放送局において、上記各受信局から通知された受信品質の検出結果をもとに各チャネルごとに所定の受信品質を満足している受信局の割合、つまり受信品質満足率を求め、この受信品質満足率に基づいて受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値にするように制御したものである。

【００５７】図４（ａ）及び（ｂ）は、この発明の第３の実施形態に係わるディジタル放送システムの放送局及び受信局の構成を示す回路ブロック図である。なお、同図において前記図３（ａ），（ｂ）と同一部分には同一符号を付して詳しい説明は省略する。

【００５８】先ず受信局ＭＳ１～ＭＳｍは、符号誤り率（ＢＥＲ：Ｂit Ｅrror Ｒate）測定するＢＥＲ測定部１１９を備え、さらに測定したＢＥＲを受信選択中のチャネル番号と共に放送局ＢＳに通知するために、変調部１１８Ｃと、送信系を備えたＲＦ部１１１Ｃとを備えている。

【００５９】変調部１１８Ｃは、上記ＢＥＲ測定部１１９により測定されたＢＥＲと、チャネル選択部１１４から出力される受信選択中のチャネル番号とを含む通知データを、ＱＰＳＫ方式等のディジタル変調方式により変調し、この変調後の信号をＲＦ部１１１Ｃに供給する。ＲＦ部１１１Ｃは、上記変調信号を所定の上りチャネル用の無線搬送波周波数に周波数変換したのち、増幅してアンテナ１１０から放送局ＢＳに向け送信する。なお、上記上りチャネルとしては、前記第３の実施形態と同様に、例えば携帯電話システムやＰＨＳ（Personal Handy phone System）の通信チャネルを使用してもよい。

【００６０】一方放送局ＢＳは、上記受信局ＭＳ１～ＭＳｍから通知データを受信するために、受信系を備えたＲＦ部７０Ｃ及び復調部９０を備えている。ＲＦ部７０Ｃは、各受信局ＭＳ１～ＭＳｍから上記上りチャネルを介して到来した無線周波信号を受信したのち中間周波信号又はベースバンド信号に周波数変換し、この変換後の受信信号を復調部９０Ｃに入力する。復調部９０は、上記受信信号をＱＰＳＫ復調することで通知データを再生する。

【００６１】また放送局ＢＳは、受信品質満足率算出部１０１及びその算出結果に応じて動作する重み制御部４０Ｃを備えている。受信品質満足率算出部１０１は、各受信局ＭＳ１～ＭＳｍから通知データにより通知された受信選択中のチャネル番号とそのＢＥＲをもとに、各放送チャネルごとに所定の受信品質を満足している受信局の割合、つまり受信品質満足率を求める。

【００６２】重み制御部４０Ｃは、上記受信率の算出結果に応じて、受信品質満足率が基準値より低い放送チャネルの送信電力を大きくし、反対に受信品質満足率が基準値より一定のマージン以上高い放送チャネルの送信電力を小さい値にするように制御する。またそれと共に、設定した重みにより増減する全チャネル多重後の総電力を一定に保持するために、電力正規化部６０に対し正規化情報を与える。

【００６３】このような構成であるから、各受信局ＭＳ１～ＭＳｍでは、受信中にＢＥＲ測定部１１９により測定されたＢＥＲが受信中のチャネル番号と共に通知データに挿入されて変調部１１８Ｃに入力され、この変調部１１８ＣでＱＰＳＫ変調されたのちＲＦ部１１１Ｃから上りチャネルを介して放送局ＢＳに向け送信される。

【００６４】一方放送局ＢＳでは、受信局ＭＳ１～ＭＳｍから無線周波信号が到来すると、この無線周波信号がＲＦ部７０Ｃで受信されたのち復調部９０で復調されて通知データが再生され、受信品質満足率算出部１０１に入力される。受信品質満足率算出部１０１では、受信局ＭＳ１～ＭＳｍから通知データが到来するごとに、この通知データに挿入されているＢＥＲとそのチャネルの番号をもとに各チャネルごとの受信品質満足率が計算され、この受信品質満足率の計算結果が重み制御部４０Ｃに通知される。

【００６５】重み制御部４０Ｃは、上記受信品質満足率の計算結果をもとに各放送チャネルごとの新たな重み係数を算出する。例えば、いま放送チャネルＣｈ＃ｉの受信品質満足率が基準値より低下したとする。そうすると重み制御部４０Ｃは、放送チャネルＣｈ＃ｉの送信電力を増加させるべく重み係数を大きい値に変更する。これに対し、放送チャネルＣｈ＃ｊの受信品質満足率が一定のマージン以上高くなったとする。この場合には、放送チャネルＣｈ＃ｊの送信電力を低下させるべく重み係数を小さい値に変更する。

【００６６】このように各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの重み係数が変更されると、この重み係数に応じて重み乗算部３１～３Ｎから各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの変調データの電力値（振幅）が可変される。そして、この電力値が可変された変調データが、多重部５０で多重化されかつ電力正規化部６０で総電力が一定となるように正規化されたのち、ＲＦ部７０Ｃからサービスエリア内ＳＥに向け送信される。

【００６７】したがって、サービスエリアＳＥ内において、受信品質に満足していない受信局が多い放送チャネルの送信電力は増加され、この結果当該放送チャネルの受信品質は改善される。

【００６８】なお、この実施形態においても、受信中の受信局がない放送チャネルについては、重み制御部４０Ｃにおいて当該放送チャネルに対する重み係数が“０”に設定され、この結果上記放送チャネルの送信電力は“０”になる。したがって、その分他の放送チャネルの送信電力を高めることが可能となり、これらの放送チャ

ネルを受信している受信局の受信品質を改善できる。

【０００９】（第４の実施形態）この発明の第４の実施形態は、セルを構成する複数の中継局を備え、放送局から配信された複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、このＣＤＭ多重化信号を自局がカバーするセルに存在する複数の受信局に向け無線送信するディジタル放送システムにあって、上記複数の受信局の各々は、自己の位置を上りチャネルを介して中継局に登録すると共に、受信選択中のチャネルの受信品質を検出してその検出結果を中継局に通知し、中継局において、上記各受信局から通知された受信品質の検出結果をもとに各チャネルごとに所定の受信品質を満足している受信局の割合、つまり受信品質満足率を求め、この受信品質満足率に基づいて受信品質満足率の低いチャネルの送信電力を受信品質満足率がそれより高いチャネルの送信電力より大きな値にするように制御したものである。

【００１０】図５は、この発明の第４の実施形態に係わるディジタル放送システムの概略構成図である。システムがカバーするサービスエリアには、複数の中継局（同図では３局の場合を図示）ＲＳ１～ＲＳ３が分散して配設してある。これらの中継局ＲＳ１～ＲＳ３はそれぞれ有線回線を介して放送主局ＢＳＳに接続され、放送主局ＢＳＳから配信される同一の各放送チャネルのデータを受信する。そして、これらの放送チャネルのデータをパイロット信号と共にＣＤＭ多重し、それぞれ自己が形成する中継サービスエリアＲＥ１～ＲＥ３へ送信する。各受信局ＭＳ１～ＭＳｍは、各中継局ＲＳ１～ＲＳ３から到来する放送信号のうちもっとも受信品質のよい放送信号を選択的に受信する。

【００１１】なお、放送主局ＢＳＳと各中継局ＲＳ１～ＲＳ３との間は有線回線以外に無線回線を介して接続することも可能である。

【００１２】図６（ａ），（ｂ）はそれぞれ、上記中継局ＲＳ１～ＲＳ３及び受信局ＭＳ１～ＭＳｍの要部構成を示す回路ブロック図である。なお、受信局ＭＳ１～ＭＳｍの構成のうち前記図５（ｂ）と同一部分には同一符号を付して詳しい説明は省略する。

【００１３】先ず中継局ＲＳ１～ＲＳ３は、前記図２（ａ）で述べた放送局ＢＳと同様に複数のＣＤＭ変調部２２０～２２Ｎを有しており、これらのＣＤＭ変調部２２０～２２Ｎにはパイロット信号発生部２１０から発生されたパイロット信号と、前記放送主局ＢＳＳから受信した複数の放送チャネルＣｈ＃１～Ｃｈ＃Ｎの放送データがそれぞれ入力される。パイロット信号は、受信局ＭＳ１～ＭＳｍで拡散符号の同期を確立するために使用する既知の信号であり、例えばオール“１”の信号パターンからなる。また、各チャネルＣｈ＃１～Ｃｈ＃Ｎの放送データには、画像と音声からなるもの、音声のみからなるもの、文字データからなるものがあり、これらのデータのタイプはチャネルにより或いは時間帯により選択される。

【００１４】各ＣＤＭ変調部２２０～２２Ｎはそれぞれ、入力されたパイロット信号及び各チャネルの放送データに対し、ＱＰＳＫ方式等のディジタル変調方式により一次変調を行ったのち、チャネルごとに異ならせたＰＮ符号を乗算して帯域を拡散させる。ＰＮ符号としては、拡散符号の同期を確立し易い周期の長いＭ系列等のロングコードに、チャネル間の直交性を確保するためのWalsh符号等の直交符号を乗算した符号が用いられる。なお、パイロット信号用としては、オール“０”のWalsh符号が用いられる。

【００１５】上記ＣＤＭ変調部２２０～２２Ｎにより変調されたデータはそれぞれ重み乗算部２３０～２３Ｎに入力される。重み乗算部２３０～２３Ｎは、上記ＣＤＭ変調部２２０～２２Ｎから出力された変調データに、重み制御部２４０から与えられた重み係数を乗算する。

【００１６】多重部２５０は、加算器からなり、上記重み乗算部２３０～２３Ｎから出力された重み付け後の変調データを加算し、この加算後のＣＤＭ変調データを電力正規化部２６０へ出力する。電力正規化部２６０は、上記重み制御部２４０から与えられる正規化情報に従い、上記多重部２５０から出力されたＣＤＭ変調データの電力（振幅）が一定レベルになるように正規化する。

【００１７】無線部（ＲＦ部）２７０は、上記電力正規化部２６０から出力されたＣＤＭ変調データを無線搬送波周波数へ変換し、帯域制限を行ったのちアンテナ２８０からサービスエリアに向け送信する。

【００１８】ところで、本実施形態の中継局ＲＳ１～ＲＳ３は、上記受信局ＭＳ１～ＭＳｍから通知データを受信するために、受信系を備えたＲＦ部２７０及び復調部２９０を備えている。ＲＦ部２７０は、各受信局ＭＳ１～ＭＳｍから上記上りチャネルを介して到来した無線周波信号を受信したのち中間周波信号又はベースバンド信号に周波数変換し、この変換後の受信信号を復調部２９０に入力する。復調部２９０は、上記受信信号をＱＰＳＫ復調することで通知データを再生する。

【００１９】また中継局ＲＳ１～ＲＳ３は、受信品質満足率算出部３００及びその算出結果に応じて動作する重み制御部２４０を備えている。受信品質満足率算出部３００は、各受信局ＭＳ１～ＭＳｍのうち自局の放送チャネルを受信している受信局から通知データにより通知された受信選択中のチャネル番号とそのＢＥＲをもとに、各放送チャネルごとに所定の受信品質を満足している受信局の割合、つまり受信品質満足率を求める。

【００２０】重み制御部２４０は、上記受信品質満足率の算出結果に応じて、受信品質満足率が基準値より低い放送チャネルの送信電力を大きくし、反対に受信品質満足率が基準値より一定のマージン以上高い放送チャネルの送信電力を小さい値にするように制御する。またそれ

と共に、設定した重みにより増減する全チャネル多重後の総電力を一定に保持するために、電力正規化部２６０に対し正規化情報を与える。

【００８１】さらに中継局ＲＳ１～ＲＳ３は、受信局登録制御部３１０を備えている。受信局登録制御部３１０は、受信局ＭＳ１～ＭＳｍから上りチャネルを介して受信した上記通知データに含まれる送信元の受信局の識別番号をもとに、自局の中継サービスエリアＲＥ１～ＲＥ３に存在する受信局のリストを作成する。このリストは、上記受信品質満足率算出部３００において、自局の放送チャネルを受信している受信局による受信品質満足率を算出するために使用される。

【００８２】また、受信局登録制御部３１０は、受信局ＭＳ１～ＭＳｍに自局の識別番号を通知する機能も有する。すなわち、上記通知データパイロット信号発生部２１０に自局の識別番号を与え、これによりパイロット信号の一部に自局の識別番号を挿入して送信させる。

【００８３】一方、受信局ＭＳ１～ＭＳｍは、受信中の放送チャネルのＢＥＲを測定するＢＥＲ測定部１１９と、登録制御部１２０とを備えている。登録制御部１２０は、符号同期部１１３により検出された受信レベルのもっとも大きいパイロット信号から送信元の中継局ＲＳｉの識別番号を抽出し保持する。そして、この受信中の中継局ＲＳｉに対し自局を登録するために、上記抽出した中継局の識別番号と、自局の識別番号とを変調部１１８Ｄに与える。

【００８４】変調部１１８Ｄは、上記ＢＥＲ測定部１１９により測定されたＢＥＲと、チャネル選択部１１４から出力される受信選択中のチャネル番号と、上記登録制御部１２０から与えられた自局が受信中の中継局ＲＳｉの識別番号と、自局の識別番号とを含む通知データを作成する。そして、この通知データをＱＰＳＫ方式等のディジタル変調方式により変調し、この変調後の信号をＲＦ部１１１Ｄに供給する。ＲＦ部１１１Ｄは、上記変調信号を所定の上りチャネル用の無線搬送波周波数に周波数変換したのち、増幅してアンテナ１１０から受信中の中継局ＲＳｉに向け送信する。

【００８５】このような構成であるから、各受信局ＭＳ１～ＭＳｍでは、任意の中継局ＲＳｉからの放送チャネルを受信し始めたとき或いは受信中に、ＢＥＲ測定部１１９によりこの受信中の放送チャネルのＢＥＲが測定される。そして、このＢＥＲの測定値が、受信中の放送チャネルの番号と共に通知データに挿入されて変調部１１８Ｄに入力され、この変調部１１８ＤでＱＰＳＫ変調されたのちＲＦ部１１１Ｄから上りチャネルを介して中継局ＲＳｉに向け送信される。また、その際上記通知データには、登録制御部１２０により抽出された上記受信中の中継局ＲＳｉの識別番号及び自局の識別番号が挿入されて送信される。

【００８６】これに対し中継局ＲＳｉでは、受信局ＭＳ１～ＭＳｍから無線周波信号が到来すると、この無線周波信号がＲＦ部２７０で受信されたのち復調部２９０で復調されて通知データが再生され、受信品質満足率算出部３００及び受信局登録制御部３１０にそれぞれ入力される。受信局登録制御部３１０では、各受信局から到来した通知データから、送信先となる中継局の番号と送信元の受信局の識別番号ががそれぞれ抽出される。そして、これらの識別番号をもとに、自局が送信している放送チャネルを受信中の受信局のリストが作成される。

【００８７】受信品率満足率算出部３００は、通知データが到来するごとに、送信通知データの送信元が、自局が送信している放送チャネルを受信中の受信局であるかどうかを、上記受信登録制御部３１０により作成されたリストをもとに判定する。そして、通知データの送信元が、自局が送信している放送チャネルを受信中の受信局であれば、当該通知データに挿入されているＢＥＲとそのチャネルの番号をもとに各チャネルごとの受信品質満足率を算出し、この受信品質満足率の計算結果を重み制御部２４０に通知する。

【００８８】重み制御部２４０は、上記受信品質満足率の計算結果をもとに各放送チャネルごとの新たな重み係数を算出する。例えば、いま放送チャネルＣｈ＃ｉの受信品質満足率が基準値より低下したとする。そうすると重み制御部２４０は、放送チャネルＣｈ＃ｉの送信電力を増加させるべく重み係数を大きい値に変更する。これに対し、放送チャネルＣｈ＃ｊの受信品質満足率が一定のマージン以上高くなったとする。この場合には、放送チャネルＣｈ＃ｊの送信電力を低下させるべく重み係数を小さい値に変更する。

【００８９】このように各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの重み係数が変更されると、この重み係数に応じて重み乗算部２３１～２３Ｎから出力される各放送チャネルＣｈ＃１～Ｃｈ＃Ｎの変調データの電力値（振幅）が可変される。そして、この電力値が可変された変調データが、多重部２５０で多重化されかつ電力正規化部２６０で総電力が一定となるように正規化されたのち、ＲＦ部２７０から中継サービスエリアＲＥｉに向け送信される。

【００９０】したがって、各中継サービスエリアＲＥ１～ＲＥ３ごとに、受信品質を満足していない受信局が多い放送チャネルの送信電力は増加され、この結果当該放送チャネルの受信品質は改善される。

【００９１】なお、この発明は上記各実施形態に限定されるものではない。例えば、前記第４の実施形態では、各中継局ＲＳ１～ＲＳ３においてそれぞれ、自局からの放送チャネルを受信している各受信局による各チャネルごとの受信品質満足率を算出し、この受信品質満足率に基づいて各放送チャネルの送信電力を可変制御する場合について述べた。しかし、これに限らず各中継局ＲＳ１～ＲＳ３においてそれぞれ、自局からの放送チャネルを

受信している各受信局による各放送チャネルごとの受信率を算出し、この受信率に基づいて各放送チャネルの送信電力を可変制御するようにしてもよい。

【００９２】また、第４の実施形態に示した各中継局ＲＳ１～ＲＳ３においてそれぞれ、パイロットチャネルや有料放送チャネル、緊急情報を放送するチャネル等のように、受信局ＭＳ１～ＭＳｍに高品質で情報を受信させる必要がある特定のチャネルがある場合に、重み制御部２４０から当該特定チャネルに対応する重み乗算部に対し他より大きな重み係数を与えて送信データに乗算させ、これにより特定チャネルの送信電力を必要期間のみ他のチャネルの送信電力より大きな値に設定するようにしてもよい。

【００９３】その他、放送局、中継局及び受信局の回路構成や、各チャネルごとの送信電力制御手順とその内容等についても、この発明の要旨を逸脱しない範囲で種々変形して実施できる。

【００９４】【発明の効果】以上詳述したようにこの発明では、複数のチャネルの情報をそれぞれ異なる拡散符号で拡散処理することにより多重化し、この多重化後の信号を複数の受信局に向けて無線送信するディジタル放送用送信局において、送信電力制御手段により、上記各チャネルの用途に応じてチャネルごとの送信電力を個別に可変設定するようにしている。

【００９５】従ってこの発明によれば、チャネル多重数を減らすことなく特定の用途のチャネルについてその受信品質を改善することができるディジタル放送システムとその送信局及び中継局を提供することができる。

【図面の簡単な説明】

【図１】　この発明の第１の実施形態に係わるディジタル放送システムの概略構成図。

【図２】　図２に示したシステムの放送局及び受信局の要部構成を示す回路ブロック図。

【図３】　この発明の第２の実施形態に係わる放送局及び受信局の要部構成を示す回路ブロック図。

【図４】　この発明の第３の実施形態に係わる放送局及び受信局の要部構成を示す回路ブロック図。

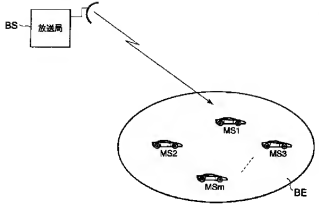
【図５】　この発明の第４の実施形態に係わるディジタル放送システムの概略構成図。

【図６】　図５に示したシステムの放送局及び受信局の要部構成を示す回路ブロック図。

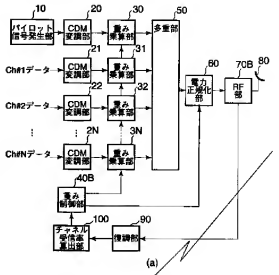
【符号の説明】

ＢＳ…放送局
ＢＥ…サービスエリア
ＭＳ１～ＭＳｍ…受信局
ＢＳＳ…放送主局
ＲＳ１～ＲＳ３…中継局
ＲＥ１～ＲＥ３…中継サービスエリア
１０，２１０…パイロット信号発生部
２０～２Ｎ，２２０～２２Ｎ…ＣＤＭ変調部
３０～３Ｎ，３３０～３３Ｎ…重み乗算部
４０Ａ，４０Ｂ，４０Ｃ，２４０…重み制御部
５０，２５０…多重部
６０，２６０…電力正規化部
７０Ａ，７０Ｂ，７０Ｃ，２７０…ＲＦ部
８０，２８０…アンテナ
９０，２９０…復調部
１０１，３００…受信品質満足率算出部
１１０…受信局のアンテナ
１１１Ａ…ＲＦ部
１１２…ＣＤＭ復調部
１１３…符号同期部
１１４…チャネル選択部
１１５…変換部
１１６…スピーカ
１１７…表示部
１１８Ｂ，１１８Ｃ，１１８Ｄ…変調部
１１９…ＢＥＲ測定部
１２０…登録制御部
３１０…受信局登録制御

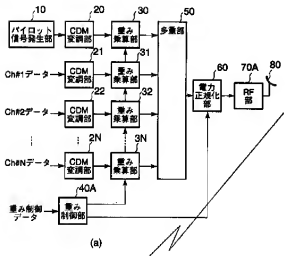
【図1】

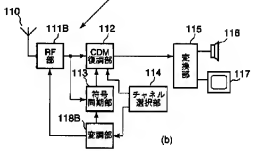

BS
放送局
MS1
MS2
MS3
MSm
BE

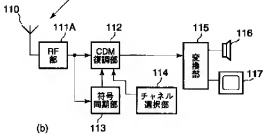
【図3】


10
パイロット信号発生部
20
CDM変調部
30
重み乗算部
50
多重部
21
31
Ch#1データ
22
32
Ch#2データ
2N
3N
Ch#Nデータ
40B
重み制御部
60
電力正規化部
70B
RF部
80
100
チャネル受信電力算出部
90
復調部
(a)

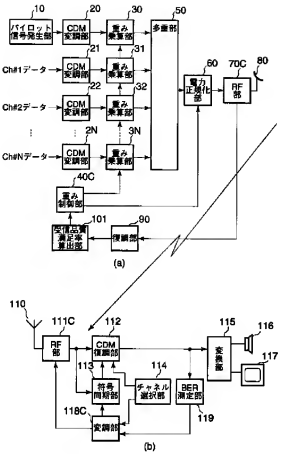
【図2】


10
パイロット信号発生部
20
CDM変調部
30
重み乗算部
50
多重部
21
31
Ch#1データ
22
32
Ch#2データ
2N
3N
Ch#Nデータ
40A
重み制御データ
60
電力正規化部
70A
RF部
80
(a)

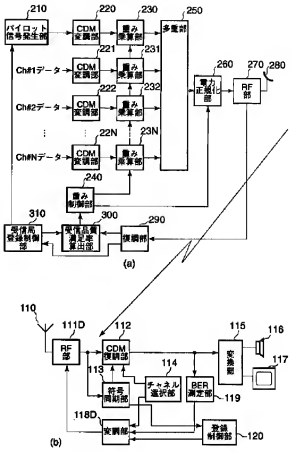

110
111B
RF部
112
CDM復調部
115
変換部
116
117
113
符号同期部
114
チャネル選択部
118B
変調部
(b)


110
111A
RF部
112
CDM復調部
115
変換部
116
117
113
符号同期部
114
チャネル選択部
(b)

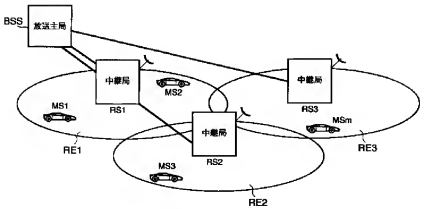
【図4】


パイロット信号発生部
CDM変調部
乗算部
多重部
Ch#1データ
Ch#2データ
Ch#Nデータ
電力正規化部
RF部
乗算制御部
受信品質測定値算出部
復調部
(a)
RF部
CDM復調部
符号同期部
チャネル選択部
BER測定部
変調部
(b)

【図6】


パイロット信号発生部
CDM変調部
乗算部
多重部
Ch#1データ
Ch#2データ
Ch#Nデータ
電力正規化部
RF部
乗算制御部
受信品質測定値算出部
復調部
(a)
RF部
CDM復調部
符号同期部
チャネル選択部
BER測定部
変調部
登録制御部
(b)

【図5】


BSS
放送主局
中継局
中継局
中継局
MS1
MS2
MS3
MSm
RS1
RS2
RS3
RE1
RE2
RE3